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ABSTRACT

The manual describes a procedure to assess to what extent a deaf-blind multiply handicapped student uses his residual hearing in the classroom. Six levels of auditory functioning (awareness/reflexive, attention/alerting, localization, auditory discrimination, recognition, and comprehension) are analyzed, and assessment activities are detailed for each level. For each activity, information is provided for expected child behavior, materials, and procedure. Included among 17 appendixes are a list of calibrated toys; information on sound levels in different environments, causes of sensori-neural loss, an analysis of relative intensity of vowels and consonants, a discussion of educational implications of hearing loss, a parent's guide for hearing aid trouble shooting, and a review of formal auditory assessments and their applicability to deaf-blind children. (CL)

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ASSESSMENT OF AUDITORY FUNCTIONING

OF

DEAF-BLIND MULTIHANDICAPPED CHILDREN

Deborah Kukla - Theresa Thomas Connolly

South Central Regional Center for Services to Deaf-Blind Children

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NEW ENGLAND REGIONAL CENTER FOR SERVICES TO DEAF-BLIND CHILDREN

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ASSESSMENT OF AUDITORY FUNCTIONING OF DEAF-BLIND/MULTIHANIDCAPPED CHILDREN

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MANUAL

RATIONALE

This assessment instrument is designed to enable a teacher to determine to what extent a deaf-blind/multiply-handicapped student uses his residual hearing in the classroom. It is addressed to the needs of two groups of children: those children with a confirmed peripheral (conductive or sensori-neural) hearing loss, and those children who, although there is no confirmation of hearing loss, are functioning as hearing impaired children.

Standard audiometric testing procedures may often prove ineffective in the assessment of auditory capabilities in children who have either known or suspected hearing impairments in addition to other handicapping conditions (Silva and Friedlander, 1974). While non-behaviorial tests (e.g. evoked auditory response) may indicate the child's sensitivity to auditory stimui, information concerning the child's ability to integrate or process sound may be lacking (Roeser, 1976). An audiogram can tell the degree of sensitivity to sound an individual has at different frequencies; it does not tell what the individual "hears," or how he uses his hearing. The auditory world is perceived according to how it is processed. Much information about the environment is processed auditorily and altered as it is internalized through this process.

> . . . this network actually detects and responds to changes that occur in the physical organization of the organism's environment. When such changes take place within the sensitivity range of the sensori-perceptual systems, (i.e., when stimuli impinge upon the organism), they in turn are modified in their organizational structure. It is these modifications that are apprehended by the lower neural centers and the cortex. Thus, we perceive not the world around us, but the changes it has induced in us. (Sanders, 1977, page 2).

Before a teacher can take maximum advantage of a child's residual hearing in the classroom, or institute an effective auditory training program, she must have reliable information concerning the child's residual

hearing capabilities and auditory functioning level. While auditory sensitivity itself cannot be improved by training, a child can learn to make better use of his residual hearing, compensating somewhat for his hearing loss. Many deaf-blind/multihandicapped children will require active teacher intervention to learn to demonstrate their capacity to respond to sound. Auditory training activities, for children who would benefit from such an intense program, additionally provide for an on-going assessment of auditory functioning.

Audition is a distance sense. It is observable only by bodily actions, such as a startle, head turn, opening a door on command, a formal sign or natural gesture, finding a picture from an oral description, or by a spoken response. Responses a teacher may observe from a child in the classroom which would indicate a child's auditory functioning level will be described. Six functional levels are utilized: awareness/reflexive, attention/alerting, localization, discrimination, recognition, and comprehension. This assessment is not intended to replace audiometric tests, but rather is intended to enable the teacher to assess how each child is using his hearing in the classroom and at what level of auditory processing he is functioning to supplement audiometric information available. This information can then be used to design appropriate educational objectives and methods for each child.

OBJECTIVES

The teacher will be able to assess the auditory functioning (level of processing) of a 'deaf-blind' or auditorily impaired-multihandicapped child.

The teacher will be able to determine to what general intensity (loudness, dB) the child is most reponsive.

The teacher will be able to modify her teaching techniques to best meet the auditory needs of the child.

Additional resources will be available to the teacher to familiarize her with audiological terms, types of hearing losses, interpretation of an audiogram, and the formal auditory tests available to enable her to better work with the audiologist in assessing each child's hearing and planning appropriate auditory goals and training programs for him.

Information on common causes of hearing aid problems will be available for the teacher to enable her to check each child's hearing aid to keep each aid in the best working condition.

LEVELS OF AUDITORY FUNCTIONING

The following six levels of auditory functioning have been compiled and adapted from the work of Doreen Pollack (1970), Elisabeth Wiig, and Eleanor Messing Semel (1976), Honore Weiner (1978), Pam Farrar (1978), and Project SKI-HI (1978) and are substantiated by numerous other researchers, Bangs, 1954; Sanders, 1977; Baltzer, 1973; Franklin, 1976; Boothroyd, 1971; Chalfant and Scheffelin, 1969. The levels are hierarchical, with the exception of localization. For a hearing child, localization develops as indicated; however, since some degree of binaural hearing is necessary for localization, a child with differing degrees of impairment for each ear may not develop the ability to localize sounds, yet may be able to discriminate, recognize, and/or comprehend auditory input. Generally, however, a child will follow the sequence outlined below.

I. Awareness/Reflexive

At the awareness/reflexive level, a child's responses are unintentional. Reflexive responses to sound may be observed, but cannot be taught. These responses are usually present in hearing children from birth, but are gradually inhibited. The normal neonate's first responses are to gross sounds (vacuum cleaner, telephone, door slamming, etc.). As the child learns that the loud sounds are not threatening to him, as they are not followed by experiences meaningful to him, he learns to ignore much of the noise in his environment unless it is significant to him.

Research has shown that sound is capable of producing changes in systems or behaviors of the child. There can be changes in heart rate, peripheral circulation, sweating, respiration, movement of eyes, face, limbs, or entire body; and complex acts such as sucking, crying or babbling

may increase or decrease (Derbyshire, 1971). Since it is highly impractical to measure all of the possible responses to sound, all hearing is not being measured. Rather, what an examiner accepts as a response determines what "hearing" he is measuring. Responses a teacher may observe in the classroom at this level include: startle, moro response (results in the child's head falling back, his arms lifting and extending away from the body and his hands opening), cessation of activity, quieting, increase in activity, widening of the eyes or eye shift, blink, raise eyebrows, crying, tensing of entire body, jerk, frown, mouth twitching, or change in respiration.

These reflexive responses may or may not be obtained in the hearing impaired child, depending on the severity of loss, mode of auditory input, and inhibition. Sounds must often be presented at relatively high intensities to elicit a response. Novel or slightly changed sounds are also more effective in obtaining a response. This has been shown in studies with normal newborns. For children 3-5 months old, it is difficult to test hearing by looking at reflexes. Reflexive responses to sound have been inhibited by this age, yet localization and discrimination are not yet developed to the point that they can be reliably used as indicators of hearing. This point will vary between deaf-blind/multihandicapped children. If a child does not respond at this level, one should still look for responses at the next level of "attention/alerting." Training would also begin at the attention/alerting level.

II Attention/Alerting

At this level, a more intentional response to sound is implied. Attention provides a selective focus for awareness. Attentional problems affect higher levels of functioning such as perceptual discrimination. Although the child knows the sound is present, he does not know its source. Attention to auditory stimuli may be inferred from the child's verbal or motor responses, such as inclining his head toward the source of sound, searching for the sound, facial expressions, or touching the ear. A child's pleasant or unpleasant responses to sound should also be noted, such as turning to or laughing at familiar near sounds. Familiar sounds may be particularly helpful in eliciting attending responses - sounds made by familiar objects (e.g. car, telephone, bell) or persons (mother, father), sounds made by moving body parts (e.g. clap hands, snap fingers, shuffle feet) or sounds from particular environments (e.g. dishes, ball, typewriter, etc.).

Inattentiveness to auditory stimuli may be related to several factors (Chalfant, 1969): low level or abscence of hearing acuity, distractibility involving competitive visual or auditory stimuli, hyperactive behavior, severe emotional disturbance, severe mental retardation, or inability to obtain meaning from auditory stimuli. Thus because a child fails to attend to auditory stimuli does not mean he lacks the auditory acuity to hear it. Other factors may account for this inattention. It simply implies that the child is not attending to the auditory stimuli used.

Several factors can be looked at in evaluating a child's attention: is he distracted by other auditory or visual stimuli? Do novel auditory stimuli assist in focusing his attention? Can he sustain attention over

time? Can he inhibit responses to irrelevant stimuli? A child may respond differently to various types of sounds (e.g. speech, non-speech, music, pure-tones).

The differentiation between sound versus no sound is a gross discrimination between sound and relative silence. It is a measure of sensitivity, since a hearing deficit will reduce the accuracy of the discrimination. For auditory processing to occur, the hearing mechanism must be capable of transmitting the mechanical, hydraulic, and electrical signals to the auditory cortex. Thus, in assessing attention, the teacher should begin with sounds the child is most likely to hear (determined from the results of an audiogram). Although sensitivity may be inferred from the teacher's observation of attending behaviors, lack of such behaviors does not necessarily imply lack of sensitivity. For some children; specific training may be necessary to indicate the presence or absence of sound. Procedures such as repeatedly turning the child's head towards the sound source, making the sound source visible to the child, pairing the sound with tactile (vibratory) sensations, or using selective reinforcement contingent on the child's response may help increase attentiveness to auditory stimuli for children who tend to ignore the significance of sound. There is always a chance that a child may have tinnitus (head noises, ringing in the ears). In such a case, detection tasks (sound verses no sound) may be difficult, although other attention tasks and exercises at higher levels may cause fewer problems.

III Localization

Localization, the ability to turn to or locate the source of a sound, develops gradually and is linked with maturation and opportunity. It depends

upon sensory integrity and central integration. This aspect of hearing contributes to a child's spatial awareness, as it helps him to retain contact with the environment at all times. Localization may be assessed by noting subtle responses, such as body movements, head turning, eye movement, or pointing towards the sound source.

When the source of sound is equidistant from both ears, that is, when it is directly in front, behind, or above the head the sound is difficult to locate, even by adults. As the sound source is moved to the left or right of the midline of the body, it is closer to one ear than the other and the closer ear is stimulated earlier. Since the acousticial complexity of a sound is partially a function of the distance from the ear, the ear closest to the sound will receive the stimulus of greater complexity before the ear farther away. The sound should then appear different to the two ears. The time difference between the detection of the signal presented to each ear should also be a clue which can be used to detect the source of sound. For these reasons, some degree of binaural hearing is necessary for localization.

Children who have difficulty with sound localization, or identifying the source of a sound, may not learn that different people have different voices, or that the sound made by one person is specific to that person and not produced by a random source. Being able to localize sounds will help the child to visually link sounds with their sources and help establish associations between sounds and objects or events.

In assessing localization, a sound which the child can hear (determined from previous level) and which is reinforcing to the child should first be presented to the side of the child's better acuity (determined from audiogram). The sound should be presented on alternate sides. Training may be necessary for the child to understand what you are requiring

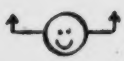
of him. Initially, he may need complete assistance in turning to the sound, then only a tap on the same side of the body the sound was presented, and finally he may localize with no assistance. An intermittent sound source is more effective than a continuous sound to which the child may habituate. Localization is difficult if the head is in a fixed position.

Localization skills develop in a specific sequence, based on a horizontal line through the two ears with sounds at a distance of one to three feet from each ear.

1. If the sound is on a lateral plane level with the ear, the child will turn directly to it. (4-7 months)

2. If a sound is to the side and on the floor, the child will first turn his head to the side of the sound, then downwards. (7-9 months)

3. The child directly localizes sounds presented out of sight on lateral and lower planes. (9-13 months)



4. The child localizes a sound above him by looking first to the side, then upwards. (13-16 months)

5. The child localizes a sound above him by looking directly upwards. (16-21 months)

6. By 21-24 months, the child can localize sound by looking directly to almost any angle. Localization to sounds in front of the child develops before localization behind the child. Sounds directly above or behind are the most difficult to localize, and may not develop until up to 36 months of age in the normal infant.

IV Auditory Discrimination

Discrimination is the beginning of integration, analysis, and categorization processes in this hierarchy of auditory functioning. A child's abilities to discriminate are largely affected by the severity of hearing loss and the child's level of overall functioning. Discrimination involves the analysis, integration, and categorization of complex signals by the sensory divisions of the cortex (brain). Because this level involves such cortical processing, it is at a higher level of functioning than sensation and attention. Some children have adequate hearing sensitivity but are not able to discriminate one sound from another.

Variables, such as selection of stimuli, mode of input, method of response, and motivational factors, will certainly affect the child's discriminatory responses on the assessment (Chalfant and Scheffelin, 1969).

Discrimination implies the ability to respond differentially to different sound stimuli. The child must differeniate properties such as loudness (intensity), pitch (frequency), duration, and rhythm.

At this level, the child is beginning to categorize and analyze the changing acoustic environment into patterns.

The auditory system processes information into patterns (Sanders, 1977) which are integrated by discriminating the qualities of the acoustic stimuli. The integration of such patterning is influenced by the auditory system as well as the relevance of the stimuli (Sanders, 1977). By categorizing qualities of an acoustic stimulus through patterns, or discrimination, information about the child's environment is internalized. It is important, in assessing discrimination, to consider the child's

ability to analyze speech and non-speech sounds. Studies with infants indicate that "some aspects of processing in a speech mode are either a genetically endowed capacity in infants, or they are learned within the first few weeks of life (Sanders, 1977)." Infants can discriminate speech versus non-speech at a very early age. One study demonstrated that young infants can even discriminate between two syllables which differ in place of articulation, (Morse, 1972).

Basically, it is the intention at this level to determine if: (1) the child can discriminate differences in the frequency (pitch), intensity (loudness), rhythm, and duration of acoustic signals; (2) the child can differentiate relevant auditory information against a background of competing sounds (Wiig and Semel, 1976), figure-ground discrimination; (3) the child can sequence a series of auditory stimuli by discriminating the sound differences; and (4) the child can identify a sound with the sound source.

1. Differences in the Characteristics of Sounds

One aspect of auditory discrimination is indicating whether two acoustic stimuli are the same or different. The child may indicate this through a wide range of behaviors. The response may vary from verbal ("same-different", "same-not the same", "I hear it") to nonverbal communication (turning toward the sound, a formal sign, natural gesture, pointing to one of a pair). The relationship of the child to the auditory stimulus will affect his perception of it, i.e. the farther away a child is, the softer the intensity of the sound. This skill is assessed for both human (vocal sounds, words, etc.) and non-human sound sources. When assessing discrimination, the teacher should begin with two stimuli of great contrast, i.e., back-front vowels, and gross sounds commonly heard. The correct response for discrimination is made from a pre-determined number

of alternatives.

2. Figure-Ground Discrimination

The ability to discern or select relevant from irrelevant auditory stimuli is a necessary auditory processing skill accomplished daily in situations in which both relevant and irrelevant stimuli vary continuously. It is important for the child to distinguish a speaker in the presence of competing background noise and messages.

> Because most verbal communication takes place by auditory speech signals, a child who is unable to attend to speech sounds or to differentiate speech sounds from the remainder of the auditory stimuli in the environment will probably experience difficulty in learning to comprehend and in acquiring language as a communication system. (Chalfant and Scheffelin, 1969, page 16).

For children who are deaf-blind, language is an area of great concern. Whether this be by means of auditory input and/or some other means of teaching language, it is critical to assess and develop the child's level of auditory functioning. A tremendous amount of environmental and verbal information is available to the auditory system. Activities for improving auditory discrimination (figure-ground) skills are intended to maximize the level of auditory functioning.

In order to process complex environmental sounds auditorily the child discriminates relevant from irrelevant information, or the figure from the ground.

Activities for assessing figure-ground skills involve presenting a significant stimulus while simultaneously presenting stimuli determined by the examiner as insignificant, competing stimuli. The target stimulus may be verbal or non-verbal and the background stimuli non-verbal or verbal, continuous or interrupted, repetitive or changing and predictable or

random.

The child then is required to respond to indicate that he has heard the significant stimulus. Research shows that figure-ground discrimination skills develop slowly and decline early (Sanders, 1977).

3. Sequencing

Discriminatory sequencing involves the skill of gradating several sounds in relation to one another, as a xylophone is gradated by frequency. This is not the same as auditory sequential memory, although this level of processing is controlled by the development of long term and short term memory. Assessment of this skill is complicated by the fact that most sound producing objects which can be sequenced by discrimination present visual cues. This type of primary sequencing may be assessed along the parameters of frequency and intensity for non-verbal sounds. Since verbal or speech input from the teacher is not controlled by the child, sequencing is more heavily reliant on memory for discriminatory processing. The sequencing aspect of discrimination leads into auditory sequential memory abilities at a higher level (not measured in this assessment) when the child recalls and repeats a series of auditory stimuli. Because of complexity of response, sequencing is not a part of this assessment.

4. Identifying Sound Source

The means by which a child links a sound with its source is a precursor to the next level of auditory processing-- recognition-- in that an association is made. The child's response may vary from turning toward the source of sound, performing an agreed upon or trained action, reproducing the sound with the correct object, or indicating the sound source. Speech sound source identification may involve discriminating between two voices by identifying the speaker.

V Auditory Recognition

This level of auditory function involves the ability to recognize and obtain meaning from sound as well as to attach meaning to sound, or a combination of sounds. A breakdown at this level may constitute a sublinquistic disturbance (Sanders, page 91). Recognition is not a problem of sensitivity since it may involve correlates such as cognition, auditory memory, the ability to localize sounds, and auditory discrimination. The child may have difficulty obtaining meaning from sound and acquiring the use of verbal language as a means of receptive and expressive communication (Chalfant and Scheffelin, page 16). Auditory recognition implies that the child is aware of sound and hears sound as well as relates the sounds to other auditory experiences for meaning. It is a complex intersensory task. If a child is anot able to recognize sound patterns as meaningful, he may benefit from training emphasizing the establishment of sounds and actions (Chalfant and Scheffelin, page 17). The child must establish a correspondence between the recurring patterns of sounds and the object or event (Chalfant and Scheffelin, page 81). Auditory recognition is the beginning of meaning connected with speech or oral language. It is dependent on detection, attention, and discrimination. The child begins to understand verbal labels as well as non-verbal signals.

> It seems likely that the first few "connections" between experience (a thing, a person, or event perceived) and a word symbol are made only as the result of constant repetition. But once the child understands that the sequence of sounds which he hears represents or is associated with a specific experience which he has perceived, the pattern of learning quickens. (Pollack, 1970, page 74).

When a child is able to recognize sounds as having meaning, he can react appropriately to them and perhaps use them himself meaningfully. The child no longer requires contextual clues and passively understands verbal labels and other auditory signals. The sound received by the ear becomes more than noise and has content information. The integration of sounds beginning at the discrimination level is now extended to integrate sounds into meaningful units (Northern and Downs, 1974). As the child is able to analyze sound, he gains a perceptual reference or meaning (Wiener, 1978).

Assessment of auditory recognition includes the child's selective responses to a few simple words that have meaning to him, reaction to prohibitive commands or simple instructions ("come here"), attention to tones of voice, and differentiated response when called by name (more attentive, smiles). A hierarchy of recognizing (and discriminating) speech labels is indicated in the assessment. Words can stand for an object when the object is not present. The child may demonstrate recognition abilities by responding to words or phrases with appropriate gestures ("patty cake", "bye-bye") or by responding appropriately to a sound signaling an event. Recognition activities may be alternate-choice, true-false, or multiple-choice type situations.

VI Comprehension

The most advanced level of auditory functioning is comprehension which involves maintaining and recalling past auditory experience, sustaining linguistic association, and transferring learned patterns to new situations. At this level the child uses auditory cues in meaningful activities outside of formal auditory training sessions. The abilitity to comprehend auditory stimuli is highly influenced by attention and memory (Wiener, 1978).

The child learns to utilize his hearing for localization, auditory memory and language development (Farrar, 1978). Comprehension also requires that the child have sufficient auditory sensitivity to attend to speech sounds, and systematized hearing. But, a hearing impairment does not always negate the child's ability to comprehend speech. No theory of audition explains why hearing impaired children have the ability to utilize discriminated features of speech in such a complex perceptual task as comprehension (Singh, page 152).

Clearly there is a difference between the detection of speech -- knowing that something is happening in the environment -- and the understanding of what is said. Once a child has recognized a sound, he can then use the sound for learning about the world around him. The goal at this level is that the child comprehends audible signals, or uses hearing to assist in such comprehension. This requires the ability to synthesize recognition skills with contextual and situational clues.

Comprehension is a speech and language-related ability dependent upon discrimination abilities to distinguish rhythm patterns, pitch and intonation, speech sounds and speech patterns, and recognition for meaning to these units of information. The auditory cortex of the brain analyzes, integrates, and synthesizes the sound flow into phonemic (letter sounds), syntactic (sentence structure), and semantic (deeper meaning) signs of language. Comprehension abilities include the child's ability to react appropriately to verbal commands and instructions increasing the length from 2-3 words to many words. Can the child follow a series of oral directions of increasing length and complexity? In instruction, this may be facilitated by organizing and structuring environmental and verbal stimuli. Since comprehension is highly language involved and it is not

the purpose of this assessment to determine the level of language development, it is suggested that for a child at this level of auditory functioning, the teacher utlize one of many language comprehension assessment tools available.

The Role of Memory

Auditory functioning is heavily reliant upon, and thus constrained by, memory abilities. Auditory tasks place a very heavy demand on short - term and long-term memory because they are temporally ordered -- the child does not have the option of reviewing the auditory input as with visual stimuli. Since the information from an auditory stimulus does not remain available and since the auditory system cannot respond to the characteristics of the stimulus as it occurs, the system must allow for the storage and then processing of the signal after the auditory information has been received.

Speech is a spatiotemporal phenomenon (Sanders, 1977). The speech wave reproduces a spatial distribution of energy through the anatomy of the ear and then presents a spatial energy pattern to the nervous system and the brain. In order to process information, the auditory system must first get enough information about the pattern. The use of memory in this process allows for detection or awareness, attention, localization, discrimination, recognition and comprehension of auditory input. If we go beyond the child's short-term memory or long-term memory abilities in our assessment or auditory training, we may not be able to determine the child's true level of auditory functioning. Memory factors affect whether a child will reach a particular level of auditory functioning and the quality of processing at each level.

Training A Child for the Assessment

One reason many deaf-blind/multihandicapped children are deemed untestable is that there is no clear and consistent response to measure. If the child does not understand the response behavior expected of him for a task it may be necessary to train the child for that behavior. For the purposes of initial assessment, this training procedure should be limited as it is not desireable for the child to memorize the tasks nor do we want him to habituate to and inhibit response to acoustic stimili.

In order to obtain an accurate assessment of a child's level of auditory functioning the child must respond in a way that is understandable and observable to the teacher such as unconditioned and conditioned reflexes.

There are many unconditioned or natural reflexes. Certain auditory stimuli will elicit unconditioned responses on the lower functioning levels (as described in assessment activities). When the teacher depends on unconditioned responses to sound, the response may diminish as the child adapts to the stimulus and the sound usually must be presented at a relatively high intensity to elicit a response.

To condition a response to be voluntary or purposeful, certain strategies of 'operant conditioning' may be followed. This means that if something changes in the child's environment, the child's behavior will change (positive reinforcers, negative reinforcers, punishment). For example, in assessing a child's response to hearing his name being called, the teacher might train his behavior by: seating the child with his back towards the teacher, calling his name, guiding him to stand up and turn around to receive a reinforcer (e.g. praise, food), then having move one foot farther away, sit down, and call again; go through this procedure until the child voluntarily turns to receive this positive reinforcer (only) when he

hears his name called. For assessment purposes, it is recommended that mainly positive reinforcers or rewards be used.

The time required to train a child to respond to auditory stimuli may seem prohibitive but it is time well-spent when important information can be obtained about a child's auditory functioning level. It will also be beneficial if an auditory training program is introduced and for re-evaluations. For example, a child may be taught to raise the forearm so that the hand is approximately at eye level. The child maintains the raised hand position until the sound is cut off -- with daily practice.

If a conditioned response has been used in the assessment, make note of this and describe the training involved on the recording forms. It is recommended that the teacher define an appropriate behavior the child already has in his repertoire and train the child to respond with this behavior consistently to the determined auditory stimulus. Some guidelines for conditioning are:

*

1. Use an instrument that is fairly loud. (Example - drum, pan with a spoon).
2. Let the child play with the instrument if he is not familiar with it.
3. Show him how many responses he is supposed to make. Hand him one response object and have him hold it up to his ear in a "listening" position. Keep the other objects out of his reach. (Begin with 6 to 8 responses).
4. Hit the instrument once and let him quickly drop the object into the container. If he does not respond, guide his hand.
5. Immediately respond to his action by clapping or giving him a very pleased expression [or a tangible reward].
6. Do not hit the instrument if he is daydreaming - wait until he listens.
7. Keep the game moving and optional - keep the game short. When the game is finished, put it away. It is better to stop while the child's interest is high than to wear him out by repeating the game. This will also encourage him to finish a game some other day when he really isn't quite so interested. He will know he will only have to play it one time.

8. Problems - (a) If he doesn't know what to do:
   i. Mother can hold his hand and guide it to make the correct response. When he begins to take over action, let him.
   ii. A third person can help the child make the response or the mother and third person can play the game while the child watches.

   (b) If he makes the wrong response: If possible, stop his hand before he drops the object into the container. If he has already dropped it, have him take it out and try again.

9. Other ways to respond.
   Turn around, take objects out of or off of something, raise head, take a step, etc.

10. After a child can respond easily to auditory and visual sound.
   (a) Hit the instrument behind the child's back. Make sure he responds quickly.

   (b) If he fails to respond, bring the instrument out in front of him again (or try using a different sound).

   (c) Don't give clues when the sound is made once the child knows what to respond to.

   . . .

   (f) Make sure the child experiences success and is rewarded for his success.

Note: if the child refuses to use the toys properly, take them away and bring them out another time. (pp. 20-21)

*from Bergland, Laughbaum, Powell, Family Education Program for Preschool Hearing Impaired Children; Alaska Treatment Center for Crippled Children and Adults, Inc., 1973.

ASSESSMENT ACTIVITIES

AWARENESS/REFLEXIVE - ATTENTION/ALERTING

GENERAL DIRECTIONS

Record a "+" if a positive reflexive or attending behavior is observed for each sound in the corresponding column. Record a "-" if no response is observed. Note under "comments" the response which was observed (e.g. startle, moro, point, turn) and for environmental sounds (and others if applicable) the situation (e.g. classroom, playground, kitchen). If a child presents a localization response to the sound stimuli, place a check (✓) under the "Localization" column and record the direction of localization on the Localization Recording Sheet. Note under each activity the sound/object used to elicit the response. When a child has consistently responded to noise making toys in two decibel ranges (e.g. less than 50 and 50-60 (dB), it is not necessary to continue to test at a higher decibel (louder) ranges. If behavioral responses to sound are not initially observed, institute a training procedure, place a check (✓) in the training column on the report form, and record the child's responses to sound after training.

Subtle responses such as tensing of body or change in respiration can more easily be detected if the examiner or second person holds the child in her lap during the assessment. A mirror in front of the child will enable the teacher to observe the child's responses when the child is sitting on her lap. A screen may be used to shield the sound producing toy from the child's vision. If a child does not respond immediately to the auditory stimuli, but a delayed response is shown, record '+D' in the appropriate column. Recording of responses will be facilitated at

all levels, prior to beginning the assessment, the teacher fills in on the recording forms the toys she intends to use for each activity. Consistency of a child's responses may be verified by performing assessment activities over a span of several days.

Awareness/Reflexive Behaviors:. . .

Include, but are not limited to, startle, moro response, cessation of activity, quieting, increase in activity, widening of the eyes or eye shift, blink, raise eyebrows, crying, tensing of entire body, jerk, frown, mouth twitching, change in respiration.

Attention/Alerting Behaviors:. . .

Include, but are not limited to, intentional verbal or motor reponses such as inclining head toward source of sound, searching for the sound, looking at sound source, reaching for sound source, facial expressions, laughing, smiling, touching the ear.

ACTIVITY 1

Expected Child Behavior:	Reflexive or attending behaviors or a trained response
Materials:	Environmental sounds (e.g. door slam, telephone ring, knock on door, car/truck/train, dishes rattling, shut drawer, chair scraping on floor, drop book on floor, ball bouncing)
Procedure:	Environmental sounds (a minimum of five) are presented to the child in as naturally occuring situation as possible, (e.g. dishes at lunchtime, ball in gym, etc.). His response to each sound is noted.

ACTIVITY 2

Expected Child Behavior:	Reflexive or attending behaviors or trained response
Materials:	Music, musical instruments (bell, drum, tamborine, xylophone, maracca, etc.), records, music boxes.
Procedure:	In a room with minimal auditory distractions, the teacher presents at least 3 musical sounds (one each of instruments, record, music box). The child's response to each sound is noted.

ACTIVITY 3

Expected Child Behavior: Reflexive or attending behaviors or trained response

Materials: Speech sounds (child's name, "no", commands - sit, come, stop, etc.) vowel and consonant sounds.

Procedure: In a quiet room, the teacher presents at least 3 speech sounds at each of the three levels of loudness: whisper, conversational, and loud. The child's response is noted.

ACTIVITY 4

Expected Child Behavior: Reflexive or attending behaviors or trained response.

Materials: Toys on calibrated toy list.

Procedure: In a room with no visual or auditory distractions, the teacher presents toy sounds (minimum of 3) in each of the 6 intensity ranges:

< 50
50 - 60
60 - 70
70 - 80
80 - 90
> 90

On the form, the names of the toys are written in the blanks under each range. A + for a positive response, and a - for no response is recorded under the reflexive and attention columns. If the teacher is not sure under which dB range a toy falls, record it under (g) other with the teacher's subjective judgement of whether it was a soft, medium, or loud noise.

LOCALIZATION

GENERAL DIRECTIONS

Observe the child's localizing (turning toward sound source) responses to sounds presented. A head or eye turn to the sound is recorded as a positive "+" response. Record a "+" or "-" under the appropriate column to indicate direction of response (horizontal; down-did he look directly down, or first to the side, and then down; up - did he look directly up, or first to the side, and then up). Record L (left) or R (right) to indicate to which side the sound was presented (e.g. +R, or -L). At least two responses to the left and two responses to the right should be noted in each of the following directions: horizontally, down (by direct or indirect turn), up (by direct or indirect turn). Each sound may be presented from a number of directions, as long as the child maintains interest. If the child is not interested in the sound/toy presented, he will not be motivated to turn toward it. Therefore, interest in the toy presented should be ascertained before presentation. After the child turns toward the sound, allow him to see/play with/touch the source of sound, repeating the sound and pointing out its source.

ACTIVITY 1

Expected Child Behavior: Head or eye turn toward sound.

Materials: Environmental noises (door slam, telephone, dishes banging, car, train, airplane, etc.).

Procedure: Observe the child's localization responses to at least three environmental noises. List noises in sound column. Note whether he turned toward the sound under the appropriate column (if applicable to location of sound source) and describe location in "other" (e.g. behind child, in front of door, behind and to the left across the room). Note approximate distance between sound source and child.

ACTIVITY 2

Expected Child Behavior: Head or eye turn toward sound.

Materials: Noise producing toys that the child has responded to auditorily at the previous levels. Sensitivity is not being tested here, so use toys you know the child can hear. Toys in which the child has shown interest will be most effective.

Procedure: Present two sound-producing toys to the child from 1 - 3 feet from his head in the following locations:

- on a horizontal plane to his left
- on a horizontal plane to his right
- to his left and downwards
- to his right and downwards
- to his left and upwards
- to his right and upwards
- in front of him (record in "other" column)
- behind him (record in "other" column)

The same toy may be used for more than one location as the child's interest warrants. Include at least one music-producing toy (instrument, radio, music box) on a horizontal, lower, and upper plane. Record as described in General Directions.

In presenting a sound-producing toy to the child, the teacher must be careful to avoid giving him visual cues as to the object's location. If seated in front of the child, the teacher may hold her arms out to both sides of the child when presenting a sound to one side. If the child is distracted by another toy or an adult, visual cues will be less likely to interfere when presenting sound stimuli for assessment of localization.

ACTIVITY 3

Expected Child Behavior: Head or eye turn toward sound.

Materials: Voice/Speech: child's name, commands (e.g. come, no, stop).

Procedure: Call the child's name or give him a command from various points in the room at distances of approximately 2 feet, 6 feet, and greater than 6 feet (at least two from each distance specified). Note the child's response under appropriate directional column or "other (specifying sound location).

DISCRIMINATION

ACTIVITY 1 (sound source/non-speech)

Expected Child Behavior: The child will indicate the object which made a sound.

Materials: 3 - 5 toys from the calibrated toy list, screen (e.g. a large box lid)

Procedure: The teacher familiarizes the child with the sounds made by each toy and determines the indicating response.

- The teacher shows two toys, demonstrates the sounds;
- Places a screen in front of the two toys;
- Produces a sound from one (a.)
- Lifts screen
- The child indicates which toy made the sound;
- Repeats two more times (b., c.)
- Repeats with three toys, once (d.).

ACTIVITY 2 (figure-ground/non-speech)

Expected Child Behavior: The child will distinguish the target toy sound from background noise by looking for it, cessation of anxiety, reaching for it, etc.

Materials: A background source - a clacker, loud buzzer, electrical appliance, radio within a 70 - 90 dB range.

Procedure:

- Child plays with desired toy.
- Teacher removes toy out of child's sight and knowledge of placement (i.e. doesn't know where it is)
- Teacher initiates background sound which continues for 10 seconds during which time the teacher makes the sound from the desired toy. Repeat once more if necessary.

ACTIVITY 3 (figure-ground/speech)

Expected Child Behavior: The child looks up, stops activity, smiles, etc. when his name is called in the presence of the background sound.

Materials: A background sound.

Procedure:

- Child is occupied with a toy.
- Background sound is introduced (not to distract child away from toy) at a 70-90 dB range.
- The teacher calls the child's name in a normal voice at a distance of 2 feet away (or measure distance).
- Repeat twice more if necessary.

ACTIVITY 4 (figure ground)

Expected Child Behavior: The child will respond appropriately to a situational verbal cue in the presence of background sound.

Materials: Background sound, 70-90 dB dependent upon cue.

Procedure: The teacher says a one-word command in a normal voice at a distance of two feet (or measure). The command should not require recognition, rather a response to a mere verbal cue. For example, the child is sitting in a chair, background sound is presented for at least 10 seconds, the teacher approaches and says "stand up" or "come here" or anything which indicatesto the child to end his sitting, (or take to a chair, wait 5 seconds and say "sit down").

ACTIVITY 5 (characteristics of sound/ non-speech)

Expected Child Behavior: The child will choose from two toys to produce the toy sound he hears.

Materials: Two pairs of toys.

Procedure: The teacher demonstrates the sounds made by each toy directing the child's hand (or whatever modification is necessary) to the same toy to reproduce the sound made by the teacher's toy.

- Two toys are set in front of the child (if the child is severely visually impaired, he may be touching the toys).
- The teacher holds the matching toys in either hand behind her back.
- The teacher makes one toy sound.
- The child reproduces the sound with matching toy.
- The teacher makes two trials for each pair.

ACTIVITY 6 (characterics of sound/ non-speech)

Expected Child Behavior: The child will match one sound can with the same sound can when presented with two.

Materials: Three pairs of sound cans (six of the same brand of soda (pop) cans; each pair filled with different things such as rice, dried beans, marshmallows; make sure the pop-top holes are securely taped closed).

Procedure: The teacher shows the child how to make the sounds by shaking the cans and shows the child how to match one can with one of two.

-The child is given one can.
-Two cans are set in front of the child (one which matches the sound produced by shaking the can the child holds).
-The child shakes the two cans in front of him, alternately comparing it with the can he has.
-The child matches his can with the can making the same sound (a.).
-Repeat two more times (b, c).

ACTIVITY 7 (characteristics of sound/ non-speech)

Expected Child Behavior: The child will touch the ball or the block to match the sound he hears when a ball or block is dropped in a can.

Materials: Three jack balls.
Three yellow 1" cubes, wooden, all the same color.
One coffee can, 1 lb.

Procedure:

-The teacher demonstrates the sounds each makes and train the response if necessary.
-The teacher sits behind the child with a coffee can and two balls, and two blocks.
-The child has a block and a ball in front of him.
-The teacher drops a block or ball into the empty can one at a time (removing after each).
-The child responds by indicating if it was a block or ball by touching or picking up the block or ball in front of him.
-Four trials (a., b., c., d.,)

ACTIVITY 8 (characterics of sound/speech)

Expected Child Behavior:

a. The child will imitate a sound made by the teacher with only auditory cues, and;

b. Stop, hesitate, or change his sound when the teacher changes.

Materials: None

Procedure:

1. The teacher makes a continuous repetitive consonant sound in a monotone until the child imitates it (or for 10 seconds, 2x/second).

-The teacher changes the sound to the second sound in the pair and continues for 5 - 10 seconds, 2x/second, and observes the child's reaction.

For example: . . .sa, sâ, sâ, sâ, kâ, kâ, kâ, kâ...

a. /g/ /m/ or /s/ /k/

b. /b/, /p/ or /d/, /t/

OR

2. Child imitates non-verbal sounds the teacher makes such as:

coughing, clicking the tongue, clapping, snapping

OBSERVATIONAL GUIDELINES

1. Does the child look directly towards the door when it slams or there is a knock?

   At the phone when it rings? Other gross environmental differentiations?

2. Does the child respond differently to the mother's or primary care takers voice than a stranger's voice? (Does the child really respond when he only hears mother's voice when she comes to pick him up after school? --the voice being the only clue).

RECOGNITION

ACTIVITY 1 (speech)

Expected Child Behavior: The child will respond to verbal signals with appropriate gestures (patty cake, bye-bye, etc.)

Materials: None

Procedure:

-The teacher sings a rhyme or verbal signal for a specific associated behavior such as: patty cake, bye-bye, eensy weensy spider, paw paw patch, ring around the rosy - all fall down, providing the child with no contextual or situational clues.

ACTIVITY 2 (speech)

Expected Child Behavior: The child will indicate the toy which the teacher names (touch, point, look, pick up, etc.).

Materials: One each of the following toys, food, and clothing: (substitutions may be made according to procedure)

ball	bat or rat or mat		
airplane	bell		
cat	can		cup
rattle	candy	or	cupcake
boat			
coat			

Procedure:

-The teacher shows the child each object and labels each with a word one time.
-Two toys are presented at a time in pairs (as follows)
-The teacher says the name of one of the two objects with mouth screened.
-The child indicates the object the teacher named.
-The following pairs are presented:

1. 2 words with different consonants and number of syllables: ball, airplane
2. 2 words with similar vowel pattern, different initial consonant and different number of syllables - cat, rattle

3. 2 words with similar vowel patterns, same initial consonant, different length - can, candy, or cup, cupcake.

4. 2 words with similar vowel patterns, different initial consonants, and same length - bat, cat.

5. 2 words with different vowel patterns, similar initial consonants, similar final consonants, and same length - ball, bell.

OBSERVATIONAL GUIDELINES

1. In the next five days, observe whether the child responds to appropriate verbal cues such as come here, give me, pick up, etc. Record the situation as well as the command the child recognized.

2. In the next five days, observe whether the child anticipates an event when he hears a gross environmental sound cue. For example, the bell means its time for lunch, stops work, gets lunch; anticipates someone's entrance when there is a knock at the door; the bus honks, its time to go. Record the situation and the environmental signal which the child recognized.

3. In the next five days, observe whether the child responds consistently to a verbal "no-no" or "don't" or "stop that" (3/5 times). Record the situation and command.

4. In the same manner, observe whether the child responds appropriately to tones of voice; i.e., angry-pouts; happy-smiles.

COMPREHENSION

ACTIVITY (speech)

Expected Child Behavior: The child will carry out instruction tasks in increasing complexity by hearing alone.

Materials: Required by the instruction tasks given by the teacher. Use materials the child is very familiar with and that are readily available.

Procedure: (the purpose is to prevent the child from basing his interpretations on one word plus the situational context, and assess the child's conceptual development, language competence, and reasoning power as it relates to this auditory input.)

a. one part commands (4)
examples: out of a pile of toys, the child is told to "pick up the block"; "skip to the door"; "open the window"; "touch my hand".

b. two part related commands (2)
examples: "pick up the block and put it in the can"; "go to the door and open it"; "go to the chair and sit down"; "open the candy and eat it".

c. three part related commands (2)
examples: take off the doll's clothes, give it a hug, and give it a bottle"; "stand up, walk to the door, and open it"; "pick up the bread, toast it and spread peanut butter on it".

d. two part unrelated commands (2)
examples: "pick up the pencil and go to the door"; "bounce the ball and stand on the chair"; "hug the doll and open the window".

(the instructions may be prefaced by the child's name)

OBSERVATIONAL GUIDELINES

1. Comprehension of environmental sounds cannot be assessed by a specific auditory activity. In the next 5 days, observe how well the child interprets environmental sounds once he has recognized them. This will depend upon his reasoning capacity and past experiences. For example, comprehension of a telephone ringing involves knowledge of what the telephone is for and how it is used; someone has dialed a number and wishes to talk. Does the child comprehend any environmental sound(s)? + or -
Describe:

*The following recording forms may be reproduced for assessment purposes.

Reflexive - Attention Levels

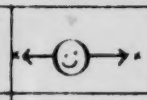
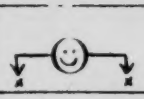
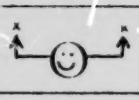
Activity	Reflexive	Attention	Training	Loc.	Comments
1. Response to Environmental Sounds					
a.					
b.					
c.					
d.					
e.					
f.					
2. Response to music					
a.					
b.					
c.					
d.					
e.					
f.					

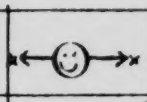
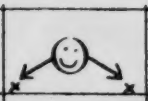
Activity	Reflexive	Attention	Training	Loc.	Comments
3. Response to voice					
a. whisper					
b. conversational					
c. loud					
4. Response to toys					
a. less than 50 dB					

Activity	Reflexive	Attention	Training	Loc.	Comments
b. 50 - 60 dB					
c. 60 - 70 dB					
d. 70 - 80 dB					
e. 80 - 90 dB					

Activity	Reflexive	Attention	Training	Loc.	Comments
80 - 90 continued					
f. greater than 90 dB					
g. Other (indicate soft, medium, or loud)					

Localization

Sound						Other
1. Environmental Noises						
a.						
b.						
c.						
2. Toys (Non-Speech)						
a.						
b.						
c.						
d.						
e.						
f.						
3. Speech/Voice						
from 2 feet						
a.						

Sound						Other
from 6 feet						
b.						
from greater than 6 feet						
c.						

OBSERVATIONAL GUIDELINES

The teacher should answer the following questions based on observations of the child for 5 consecutive days. (Did he respond as indicated at any time during the 5 days?) The questions will serve to direct the teacher's observations.

Awareness/Reflexive - Attention/Alerting

1. Does the child respond to:

   a. gross sounds such as the slamming of a door, ringing of a telephone, or flushing of a toilet?

      No _____ Yes _____ (describe)

   b. music (instruments, music box, record, radio)?

      No _____ Yes _____ (describe)

   c. voice?

      No _____ Yes _____ (describe)

Localization

1. Does the child turn towards

   a. sounds in his environment (door, telephone, etc.)?

      No _____ Yes _____ (describe)

b. familiar voices (e.g. his mother calling from the doorway)?

No _____ Yes _____ (describe)

2. Can the child find familiar toys in his environment from auditory cues alone?

No _____ Yes _____ (describe)

AUDITORY DISCRIMINATION

__ 1. Sound Source (non-speech)

circle the toy which the teacher activates
mark an X on the name of the toy the child indicates

a. toy: _____ toy: _____

dB level: _____ dB level: _____

b. toy: _____ toy: _____

dB level: _____ dB level: _____

c. toy: _____ toy: _____

dB level: _____ dB level: _____

d. toy: _____ toy: _____

dB level: _____ dB level: _____

toy: _____

dB level: _____

child's indicating response: _____

criterion: 2/4, (credit: (circle) + or -)

comments:

__ 2. Figure - Ground (non-speech)

background sound: _____, dB range: _____

target toy sound: _____, dB range: _____

criterion: expected child behavior elicited once

(credit: (circle) + or -, repeat? _____)

comments:

___3. Figure - Ground (speech)

background sound: _____ dB level: _____

criterion: expected child behavior elicited once

distance: _____ feet, inches

(credit: (circle) + or - ; 1st, 2nd or 3rd trial?)

comments:

___4. Figure - Ground (speech)

background sound: _____ dB level: _____

verbal cue: _____, distance: _____ feet, inches

child's pre-cued behavior: _____

child's response to verbal cue: _____

criterion: appropriate expected child behavior once

(credit: (circle) + or -)

comments:

___ 5. Characteristics of Sound (non-speech)

		trials 1	2
pair 1:	_____ and _____	yes/no	yes/no
pair 2:	_____ and _____	yes/no	yes/no

criterion: 2/4 correct expected child behaviors

(credit: (circle) + or -)

comments:

___ 6. Characteristics of Sound (non-speech)

a. yes/no b. yes/no c. yes/no

criterion: 3/4 correct expected child behaviors

(credit: (circle) + or -)

comments:

___ 7. Characteristics of Sound (non-speech)

a. yes/no b. yes/no c. yes/no d. yes/no

criterion: 3/4

(credit: (circle) + or -)

comments:

___ 8. Characteristics of Sound (speech)

a. //, // imitate? yes/no discriminate change? yes/no

b. //, // imitate? yes/no discriminate change? yes/no

criterion: 1 imitation and one discrimination

(credit: (circle) + or -)

comments:

Observational Guidelines

In the next five days, observe whether:

___ 1. the child looks directly towards the door when it slams or there is a knock? At the phone when it rings? or makes other gross environmental discriminations? + or - , explain:

___ 2. the child responds differently to the mother's or primary care taker's voice than a stranger's voice? (does the child <u>really</u> respond when he only hears mother's voice when she comes to pick him up? -- voice being the only clue). Record.

___ _____

___ Total number of +'s

criterion: 8/10

(credit for discrimination: + or -)

Auditory Recognition

___ 1. verbal signal: _____

child's response: _____

criterion: expected child behavior once.

(credit: + or -)

___ 2. child's response, indicating behavior: _____

toy pairs: 1._____ and _____ yes/no

2._____ and _____ yes/no

3._____ and _____ yes/no

4._____ and _____ yes/no

5. _____ and _____ yes/no

criterion: 3/5 correct indications

(credit: + or -)

Observational Guidelines

___ 1. In the next 5 days, observe whether the child responds appropriately to verbal cues such as come here, give me, pick up, etc. Record the the situation as well as the command the child recognized. (+ or -)

___ 2. . . . observe whether the child anticipates an event when he hears a gross environmental sound cue. For example, the bell means its time for lunch, stops work, gets lunch; anticipates someone's entrance when there is a knock at the door; the bus honks, its time to go. Record the situation and the environmental signal which the child recognized. (+ or -)

___ 3. . . . observe whether the child responds consistently to a verbal "no-no" or "don't" or "stop that" (3/5 times). Record the situation and command. (+ or -)

___ 4. In the same manner, observe whether the child responds appropriately to tones of voice; i.e., anger-pouts; happy-smiles. (+ or -) . Record.

___

___ Total +'s

Criterion 5/6

(Credit for Recognition: + or -)

COMPREHENSION

___ 1. Speech

(5/10 = +)

commands

a. one part commands

1. _____

2. _____

3. _____

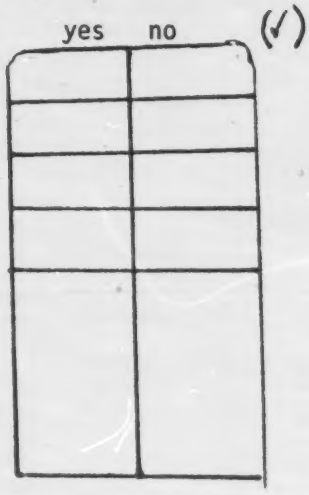
4. _____

criterion: 3/4

b. two part related commands

1. _____

and _____



Comprehension cont'd

	yes	no	(✓)
2. _____ and _____			
c. three part related criterion: 1/2			
1. _____, _____, and _____.			
2. _____, _____, and _____.			
d. two part unrelated criterion: 1/2			
1. _____ and _____.			
2. _____ and _____.			

OBSERVATIONAL GUIDELINES

___ 1. Comprehension of environmental sounds cannot be assessed by a specific auditory activity. In the next 5 days, observe how well the child interprets environmental sounds once he has recognized it. This will depend upon his reasoning capacity and past experiences. For example, comprehension of a telephone ringing involves knowledge of what the telephone is for and how it is used ; someone has dialed a number and wishes to talk. Does the child comprehend any environmental sound(s)?
+ or -
Describe:

___

___ Total +'s (2)
Criterion for Comprehension:
a. 3/4 b. 1/2 and c. 1/2 or d. 1/2 and observation '+'
(5/10 and 1/1 = 6/10)

Credit for Couprehension: + or -

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child's name _____ date _____

name of assessor (s) _____ date of birth _____

PROFILE
of auditory functioning

Fill in the block for each level the child passes and record comments.

Levels		Comments
Comprehension		
Recognition		
Discrimination		
Localization		
Attention/Alerting		
Reflexive/Awareness		

Are there any general observations of limitations across levels that you have noticed? (such as dB ranges, speech vs. non-speech, etc.)

Recommendations for auditory training:

APPENDICES

APPENDIX I

CALIBRATED TOYS

The following toys have been calibrated with a sound level meter according to intensity - that is, the loudness level of each toy has been measured. They have been calibrated at 6", 1', 2', 3', and 6'. The lower the decibel (dB) level, the softer the sound the toy produces. The higher decibel levels indicate louder sounds.

These calibrations (measurements) are not exact. The loudness of the sound produced depends on the person activating the toy (e.g. how hard she shakes toy), the surface upon which it is activated (e.g. table, rug, tile), and the background noises in the room itself. We have attempted to keep these variables as consistent as possible in calibrating the toys. The teacher should likewise present the toys in the same manner if she wishes the loudness level to remain constant.

The toys have been divided into ranges of 10 decibels and are listed within each range in approximate order of increasing intensity. It is recommended that the teacher calibrate other toys in her classroom, environmental sounds around the classroom, and her voice and add them to the following lists. A sound level meter is usually available from an audiologist for these calibrations. All toys have been calibrated on a 1½" thick tabletop in a sound proof room unless otherwise indicated. Toys with an asterisk (*) are included in the Auditory Assessment Kit and are available on loan from the South Central Regional Center for Services to Deaf-Blind Children.

Less than 50 dB

	Toy	Manufacture	Directions	Distance from child
*	Baby Action Ball (yellow hourglass ball)	Playskool	turn over and let pieces fall through	6", 1', 2'
*	Music Box Owl	Fisher Price	wind up to play music ("Cradle Song")	6'
*	"Rattle Pals" - blue whale red snail yellow fish rattles	Child Guidance First Play	shake back and forth hard	3'
	small red hopping frog	Japan	fully wound, let hop on table	6'

50-60 dB

	Toy	Manufacturer	Directions	Distance from Child
*	Rattle Pals- plastic whale snail fish	Child Guidance First Play	shake back and forth hard	6", 1', 2'
*	Music Box Owl	Fisher Price	wind up and let play	6", 1', 2', 3'
*	Clear Casta (red & blue plastic)	Japan	pinch together softly	2', 3'
*	Wooden tube knocker with stick	Taiwan	hit softly	2'
*	Flower rattle	Fisher Price	shake side to side 4x/sec.	2', 2'
	Wooden windup truck	Mattel	fully wound, hold by tower and let wheels spin	6'
	Happy Hoppers	Fisher Price	roll back and forth (12") by handle on floor (rug)	6'

60-70 dB

	Toy	Manufacturer	Directions	Distance from Child
*	Flower Rattle	Fisher Price	shake side to side 4x/sec.	6"
*	Clear Casta	Japan	(1)pinch together hard (2)pinch together soft	6' 6", 1'
	Bells		shake soft	2'
	Kittie in the Keg (nesting barrells)	Child Guidance	put small light green barrell in the large dark green barrell-turn from side to side 2x/sec.	6", 1', 2', 3'
*	Rubber jacks ball		release from 6" into 1 lb. metal coffee can	2', 3'
	Roly Poly Chime Ball	Fisher Price	roll back and forth on table	6", 1', 2', 3'
*	Happy Apple	Fisher Price	roll back and forth on table	6", 1', 2', 3'
	Whistling Ride-it Loco	Marx	press the yellow toot horn soft-medium	3', 6'
	Yellow plastic squeeze porcupine	Space Lanco	squeeze hard	3', 6'
	Pound-a-Round	Child Guidance	push down top and release	3', 6'
	Shape-o-Ball	Tupperware	drop piece in	3'
	Queen Buzzy Bee	Fisher Price	roll back and forth on floor (rug) within 12", holding it with your hand	6'

60-70 dB (continued)

Toy	Manufacturer	Directions	Distance from Child
Halloween round tin cat rattle		shake 4x/sec.	6'
* Wooden clacker	Creative Playthings	bang together 2x/sec.	6'
Busy Box	Koner	push botton	6", 1', 2', 3'
Jalopy	Fisher Price	roll bark and forth within 2", holding car at center	6'
small red wind-up hopping frog	Japan	fully wound, let hop on table	2', 3'
Wooden wind-up truck	Mattell	fully wound, hold by tower in center of car and let wheels spin	2', 3'
Raggedy Ann plastic rattle	Bobbs-Merrill	shake back and forth 4x/sec.	3', 6'

70-80 dB

Toy	Manufacturer	Directions	Distance from Child
Shape-o-Ball	Tupperware	drop piece in, one	6", 1', 2'
Raggedy Ann plastic rattle	Bobbs-Merrill	shake back and forth	6", 1'
Halloween noise maker		swing around	6'
Hopping Frog, windup 1½"	Japan	fully wound, put on table	6", 1'
Ping Pong Ball in can		release into 1 lb. metal coffee can from 6"	2', 3'
Tennis Ball in can		release into 1 lb metal coffee can from 6"	1', 2', 3'
* Jacks Ball in can		release into 1 lb. metal coffee can from 6"	6", 1'
* Wooden clacker	Creative Playthings	shake 2x/sec.	6", 1', 2'
* Clear Casta plastic red and blue	Japan	clack hard	2', 3'
* Chatter Telephone	Fisher Price	turn dial release roll back & forth on table	6", 1', 2', 3' 3' 6", 1', 2', 3'
Porcupine Squeeze Toy	Space Lanco	squeeze head	6", 1', 2'

70-80 dB (continued)

Toy	Manufacturer	Directions	Distance from Ch
Busy Box	Kohner	- up on table, turn dial on clock - move car back and forth	6", 1', 2' 2', 3'
Cymbals		bang together very softly	2'
bells (3 on a band)		shake hard	2'
tambourine		shake hard	2'
* plastic maracca		shake softly	2'
* tin horn		blow softly	2'
Jack-in-the-Box	Fisher Price	push button for his voice	1', 2', 3'
Halloween noise maker, tin rattle		shake 4x/sec.	1', 2', 3'
Jalopy	Fisher Price	roll back and forth within 12" holding car at center	2', 3'
Popcorn Top	Child Guidance	push down top and release	3'
Pull-a-Tune	Fisher Price	roll back and forth within 12"	6", 1', 2', 3'
Ride It Loco	Marx	press the yellow toot horn hard	3', 6'
Queen Buzzy Bee	Fisher Price	roll back and forth on table with hand within 12"	2', 3'

70-80 dB (continued)

Toy	Manufacturer	Directions	Distance from Child
Wooden Knocker		hit hard with stick	2'

80-90 dB

Toy	Manufacturer	Directions	Distance from Child
Queen Buzzy Bee	Fisher Price	roll back and forth on table within 12"	6", 1'
Jack-in-the-Box	Fisher Price	push button for his voice	6"
Halloween noise maker tin rattle		shake 4x/sec.	6"
* Clear Casta red, blue	Japan	pinch together hard	6", 1"
Busy Box	Kohner	turn clock dial push car telephone dial	2', 3' 6", 1' 6", 1', 2', 3'
Popcorn Top	Child Guidance	push down top and release	6", 1', 2'
* Chatter Telephone	Fisher Price	release dial	6", 1', 2'
Jalopy	Fisher Price	roll back and forth within 12" holding car at center	6", 1'
* Plastic Maracca		shake hard	2'
* Shake and Sort	Child Guidance	turn over and let fall shake hard, beads fall from big holes on top, shake down	2', 3'
* 1" wooden cubes in coffee can		release from 6" above into 1 lb. metal can	6", 1', 2', 3'
ping pong ball in coffee can		release from 6" above into 1 lb. metal can	6", 1'

80-90 dB (continued)

Toy	Manufacturer	Directions	Distance From Child
Tennis ball in coffee can		release from 6" above into 1 lb. metal can	6"
* Tin horn		blow hard	2'
Halloween noise maker tin swinging handle		swing around	6", 1', 2', 3'
Postal Station	Play Skool	drop cube or cylinder into empty box	3'

More than 90 dB

	Toy	Manufacturer	Directions	Distance from Child
*	Shake & Sort	Child Guidance	- turn over and let fall, big holes on top then turn over until all colors separated - shake hard to get beads from big holes on top, turn to shake down, all together	6", 1'
	Postal Station	Playskool	drop cube or cylinder into empty box	6", 1', 2'
	Cymbals		bang together hard	2'

APPENDIX II

Sound Levels of Some Noises in Different Environments*

Community (outdoor)

Subsonic jet, 100 feet from takeoff - 120 dB
Jet flyover at 1000 feet - 103 dB
Boeing 707 on landing approach at 6000 feet - 106 dB
Helicopter at 100 - 100 dB
Motorcycle at 25 feet - 90 dB
Diesel truck, 40 mph at 50 feet - 94 dB
Diesel train, 40 to 50 mph at 50 feet - 83 dB
Truck accelerating at 50 feet - 86 dB
Passenger car, 65 mph at 25 feet - 77 dB
Freeway at 50 feet (heavy traffic) 70-80 dB
Subway train (Chicago) on platform - 95 dB
Subway train (Chicago) inside car - 105 dB
Jackhammer (3 feet) - 105 dB
Rock drill (100 feet) - 92 dB
Power mower (loud type) - 105 dB
Power mower (smaller) - 97 dB
Air conditioning unit, 20 feet - 60 dB

Home (indoor, exclusive of factories)

Rock and roll band - 100 to 114 dB
Kitchen garbage disposal unit - 80 dB
Vacuum cleaner - 84 dB
Dishwasher - 69 - 75 dB
Hair dryer - 77 dB
Sewing machine - 64 dB
Electric shaver - 85 dB
Shower - 78 dB
Automatic wasking machine - 64 to 78 dB
Audio on TV - 70 dB
Radio - 78 dB
Electric typewriter, 10 feet - 65 dB
Private business office - 55 dB
Crowd cheer in basketball area - 115 dB
Living room in residential area (all appliances off) - 43 dB
Average conversation - 45 dB
Whisper at 15 feet - 30 dB
Minimum level for residential Chicago area at night - 35 dB

The above levels are approximate and may vary as much as 10 dB. Levels furnished by the Department of Health, Education, and Welfare and General Radio Company. The majority of readings were taken on the "A" scale of a sound level meter.

*Shapiro, S.L., the noise pollution crisis, Audicibel, 22, 1973, 138.

Sound Levels of Some Noises in Different Environments (cont.)

	Noise Level (dB)	Response	Hearing Effects	Conversational Relationships
Carrier Deck Jet Operation	140	Painfully loud	Contributes to hearing Impairment	
	130	Limit of amplified sound		
Jet Takeoff (200 feet)	120			
Dischotheque	110			
Auto Horn				
Garbage truck	100			Shouting in Ear
New York Subway Station	90	Very Annoying Hearing damage (8 hours)		Shouting at 2 feet
Pheumatic drill (50 feet)	80			Very loud Conversation 1 foot
Alarm clock				
Freeway traffic (50 feet)	70	Telephone use difficult		Loud Conversation, 2 feet
Air Conditioning Unit (20 feet)	60	Intrusive		Loud Conversation, 4 feet
Light Auto Traffic (100 feet)	50	Quiet		Normal conversation, 12 ft.
Living room	40			
Bedroom				
Soft whisper (15 feet)	30	Very Quiet		
Broadcasting Studio	20			
	10	Just Audible		
	0	Threshold of Hearing		

Shapiro, S. L. The noise pollution crisis, Audicibel, 22, 1973, 140.

APPENDIX III

Relative Intensity of Vowels and Consonants

	Speech Sound		Decibel Value
most intense vowel	ô	(talk)	0.0 db
	o	(ton)	0.0 db
	ō	(tone)	-1.1 db
	ī	(bite)	0.0 db
	ou	(bout)	0.0 db
	a	(tap)	-2.8 db
Least intense vowel	e	(ten)	-6.5 db
	a	(top)	0.3 db
	ū	(took)	-1.9 db
	u	(tool)	-5.7 db
	a	(tape)	-1.8 db
	i	(tip)	-4.5 db
	e	(team)	-3.7 db
	r	(err)	-4.5 db
	l	(let)	-7.4 db
	ng	(ring)	-6.2 db
most intense consonant	sh	(shot)	-6.8 db
	ch	(chat)	-10.3 db
	n	(no)	-13.3 db
	m	(me)	-14.9 db
	th	(that)	-15.8 db
	t	(tap)	-13.6 db
	h	(hat)	-18.3 db
	k	(kit)	-14.7 db
	j	(jot)	-10.3 db
	f	(for)	-22.3 db
	g	(get)	-13.1 db
	s	(sit)	-21.9 db
	z	(zip)	-18.4 db
	v	(vat)	-19.9 db
	p	(pat)	-18.6 db
	d	(dot)	-12.2 db
	b	(bat)	-16.3 db
least intense consonant	th	(thin)	-28.8 db

The measurement of the intensity of these vowel and consonant sounds relative to the ô sound indicates which sounds are perceived as louder and which sounds are softer. When presenting speech discrimination sounds, this may be helpful to the teacher in determining the intensity of the individual sounds and in choosing appropriate sounds to present. Thus, the teacher may be able to determine if a child has difficulty in processing certain loudness levels of speech sounds.

APPENDIX IV

FORMANTS: THE DETERMINATION OF VOWEL FREQUENCIES FOR AUDITORY ASSESSMENT AND TRAINING

A vowel sound has one fundamental frequency (pitch) but, because voice is not made of pure tones, other frequency sounds are present. When sounds are analyzed according to frequency, a series of four successive bands above the fundamental frequency band result. These bands are called "formants." The formants (or bands of frequency) determine that particular sound. The first two bands vary in frequency from sound to sound, forming patterns which are characteristic of individual phonemes (vowel and consonant sounds). The third formant is less variable; so is of less importance in auditory differentiation. Because the fourth formant remains fixed at approximately the same frequency for all vowel sounds, it does not contribute to the auditory perception of vowels. Recognition of vowels is possible if one is able to hear only the first two formants. By comparing the upper frequency limits of the second formant of various vowels, it is possible to see which vowel sounds could be most easily recognized by a child with a high frequency hearing loss that is, which vowels have the least high frequency energy.

In terms of the frequency limits of the second formant, back vowels are most easily identified (given limited high-tone hearing) followed by mid-vowels and front vowels, respectively, in ease of recognition. Because diphthongs (e.g. ou, oy, ea-two vowel sounds together) are composed of two vowel sounds, the upper frequency limit is determined by the higher of the two vowels. In other words, back vowels have a lower frequency than front vowels.

Thus, a child with a high frequency hearing loss (as many deaf-blind children have) would most easily be able to differentiate back vowels.

Front vowels would be most difficult for him. For both auditory assessment and training of the child, the teacher should then begin with attention to and discrimination of back vowels, followed by mid-vowels, then front vowels in words, or if possible, in isolation. Refer to the child's audiogram to determine the frequencies in which his hearing is best. (Remember on the audiogram, hearing is tested at 250, 500, 1000, 2000, 4000, 6000, and 8000 Hz. Check the child's audiogram for losses in these frequency ranges).

For Any Vowel (Male Voice)

Formant I: Will fall within approx. 250-700 cps (Hz)
Formant II: Will fall within approx. 700-2400 cps (Hz)
*Formant III: Will fall within approx. 2200-3000 cps (Hz)
Formant IV: Will fall within approx. 3200-3700 cps (Hz)

} frequencies in these 2 ranges are most important in differentiating vowel sounds

* /ɝ/ Male voice - third formant average, 1690 cps

These tables show the frequencies of back, middle, and front vowels for men's, women's, and children's voices.

TABLE I

Back Vowels		Second Formant Limit		
		Men	Women	Children
/ɔ/	ball	840 cps	920 cps	1060 cps
/u/	boot	870 cps	950 cps	1170 cps
/o/	o-bey	900 cps	no data	no data
/ʊ/	book	1020 cps	1160 cps	1410 cps
/ɒ/	pot	1090 cps	1220 cps	1370 cps

TABLE II

Mid Vowels	Second Formant Limit	
	Men	
/ʌ/ cup	1190 cps	
	Women	
	1400 cps	
	Children	
	1590 cps	
		Third Formant Limit
/ɝ/ bird	Men	Men
	1350 cps	1690 cps
	Women	Women
	1640 cps	1960 cps
	Children	Children
	1820 cps	2160 cps

TABLE III

Front Vowels

Vowel	Second Formant Limit		
	Men	Women	Children
/æ/ bat	1720 cps	2050 cps	2320 cps
/ɛ/ bed	1840 cps	2330 cps	2610 cps
/ɪ/ bit	1990 cps	2480 cps	2730 cps
/i/ beet	2290 cps	2790 cps	3200 cps
/e/ cha-ot-ic	2300 cps	no data	no data

TABLE IV

Diphthongs

Vowels		Second Formant Limit		
		Men	Women	Children
/oʊ/	boat	882 cps	no data	no data
/aʊ/	cow	1400 cps	"	"
/ɔɪ/	boy	1908 cps	"	"
/aɪ/	bite	1942 cps	"	"
/ju/	you	2160 cps	"	"
/eɪ/	bay	2228 cps	"	"

This is very detailed information, but it is intended to help the teacher understand what speech sounds the child is or is not understanding.

Adapted from: Jeffers, Janet; "Formants and the Auditory Training of Deaf Children," The Volta Review, No. 68, June, 1966, p. 418-423.

APPENDIX V

Causes of Sensori-neural Loss

Antenatal and Neonatal

- Rh incompatability
- ABO incompatability
- Hyperbilirubinemia, jaundice, or kernicterus not associated with the above
- Prematurity
- Anoxia not associated with prematurity
- Physical trauma to mother during pregnancy
- Maternal infections
  - Rubella
  - Congenital syphillis
  - Asian influenze
  - Cytomegalic Inclusion Disease
  - Congenital Toxoplasmosis
- Maternal ingestion of ototoxic drugs
  - Streptomycin
  - Dihydrostreptomycin
  - Gentamyxin
  - Kanamycin
  - Neomycin
  - Ethacrynic Acid
- Genetic Disorders
  - Waardenberg's Syndrone
  - vonRecklinghausen's Disease
  - Pendred's Syndrone
  - Meniere's Syndrone
  - Leopard Syndrone
  - Usher's Dyndrone
  - Jervel and Lang-Nielsen Disease
  - Alport's Syndrone
- Hereditary
  - Dominant
  - Recessive
  - Sex-linked

Acquired

- Meningitis
- Measles
- Mumps
- Ototoxic
  - Kanamycin
  - Gentamycin
  - Streptomycin
  - Dihydrostreptomycin
  - Neomycin
  - Polymixin - B
  - Asprin (ASA)
- Noise induced
- Head trauma
- Presbycusis
- Acoustic neuroma

Causes of Conductive Loss

Antenatal and Neonatal

- Genetic Disorders
  - Pierre-Robin Syndrone
  - Treacher Collins
  - First Arch Syndrone
  - Hunter-Hurler Syndrone
  - Osteogenesis Imperdecta
  - Crouzan's Disease
  - Apert's Syndrone
  - Otopalatal Digital Syndrone
  - Klippel Feil Syndrone
- Otosclerosis
- Cleft lip and palate

Acquired

- Tympanic membrane performation
- Otitis media
- Impacted cerumen
- Cholesteotoma
- Mastoidectomy and/or Tympanoplasty
- Mastoiditis
- Head trauma

APPENDIX VI

Relations between hearing level in dB,
severity of handicap, and probable needs

Hearing level dB ANSI-1969 reference*			
Children	Adults	Severity of Handicap	Probable Handicap and Needs
0 to 20	0 to 26	Normal	Usually of no handicap, but may be of educational significance in the upper range of normal.
21 to 35	27 to 40	Mild	Has difficulty hearing faint speech. May need preferential seating in the classroom and may benefit from amplification.
36 to 55	41 to 55	Moderate	Understands conversational speech at 3 to 5 feet; needs hearing aid; auditory training, preferential seating, speech and language intervention; small, self-contained classroom.
56 to 70	56 to 70	Moderately-Severe	Understands conversational speech only with great difficulty. Requires all of the above and may benefit from initial placement in a day class for the hearing impaired.
71 to 90	71 to 90	Severe	May hear loud voice at about one foot; may identify environmental noises; may distinguish vowels but not consonants; needs amplification and services as outlined above.
91 plus	91 plus	Profound	May hear some loud sounds, but may not rely on hearing as a primary channel for communication. special day class or residential program for the hearing impaired; services as outlined above; may also be considered as a potential candidate for total communication.

*Average of hearing levels for 500, 1000, and 2000 Hz.

Adapted from: Sweitzer, R. S., "Audiologic Evaluation of the Infant and Young Child" in Hearing Loss in Children edited by B. F. Jaffe. University Park Press, Baltimore, 1976.

APPENDIX VII

EDUCATIONAL IMPLICATIONS OF HEARING LOSS

amount of loss (dB)	effect
1. less than 30 dB	May have difficulty in hearing faint or distant speech; is likely to "get along" in school, and at work requiring listening. Lip reading and favorable seating.
2. 30 to 45	Understands conversational speech at 3 to 5 feet without too much difficulty; may have difficulty if talker's voice is faint or if face is not visible. Lip reading, hearing aid (if suitable) and auditory training, speech correction and conservation, favorable seating.
3. 45 to 60	Conversational speech must be loud to be understood; considerable difficulty in group and classroom discussion and perhaps in telephone conversation. Lip reading, hearing aid, and auditory training, special language work, favorable seating or special class.
4. 60 to 80	May hear voice about a foot away; may identify environmental noises and may distinguish vowels, but consonants are difficult to perceive. Probably special educational procedures for deaf children with emphasis on speech, auditory training, and language with the possibility that the child may enter regular school.
5. More than 80	May hear only loud sounds. Special class or school for the deaf. Some of these children eventually enter regular high schools.

From Silverman, S.R.: The education of children with hearing impairments, J. Pediat., 62:254-260, 1963.

APPENDIX VIII

Formal Auditory Assessments and Their Applicability to Deaf-Blind Children

Generally, two types of formal auditory assessment devices are used - behavioral tests and non-behavioral tests. Behavioral tests rely on intentional or non-intentional overt responses of the child when, or shortly after, an auditory stimulus is presented. Non-behavioral tests rely on physiological body changes to sound rather than overt responses on the part of the child (Roeser, 1976). The behavioral tests are listed here in order of the increased sophistication of the response required of the child and the corresponding increase in accuracy of results.

Assessment Method	Description	Applicability
BEHAVIORAL		
Behavior Observation Audiometry (BOA)	The child is observed for any response to sound (reflexive or voluntary), such as startle, localization, quieting or cessation of activity, instigation of activity (laugh, cry, blink, etc.).	Applicable as a gross form of assessment. It may be the only successful testing method for younger deaf-blind children (less than 1-1½ years) and for older deaf-blind children for whom all other behavioral methods have failed.
Conditioned Orientation Response Audiometry (COR)	A visual reinforcer is provided when an appropriate localization response occurs. The child is seated in a sound room, stimuli are presented through loud speakers on top of which a novel object is placed which illuminates initially when a sound is presented, and later only after a child correctly localizes the sound.	Generally successful with deaf-blind children especially those older than 5-6 years, if they have sufficient visual acuity to perceive the light. Not useful for children under one year of age or children with no light perception.

Assessment Method	Description	Applicability
Play Audiometry	The child performs an overt 'play' response, such as dropping a block in a bucket or putting a ring on a ringstack, when a sound stimulus is presented.	More objective than BOA or COR, but it may take a long time to train a child to respond as required. It assumes the activity is interesting to the child and the response is rewarding (Roeser, 1976). May be good for deaf-blind children 8-10 years or older. A parent or teacher could train the child in the appropriate response mode to prepare him for the auditory assessment. Useful in confirming the results from other techniques as the child matures.
Standard/Conventional Pure Tone Audiometry	Child is to make an overt response such as raising his hand or pressing a signal button in the presence of a sound.	Generally has limited applicability to deaf-blind children because of their inability to follow verbal directions and the inability of the examiner to demonstrate the task due to child's visual impairment.
Impedance	Measurement of middle ear function using an electro acoustic impedance bridge. The eardrum is subjected to varying degrees of air pressure. The compliance of the eardrum in relation to the amount of positve or negative air pressure exerted against it is recorded on a graph.	Has been successful in detecting middle ear involvement in deaf-blind children for whom traditional bone and air conduction methods were not reliable.

NON-BEHAVIORAL

Assessment Method	Description	Applicability
Autonomic Responses: Respiration Audiometry Heart Rate Audiometry Galvanic Skin Response	Makes use of conditioned reflexes. A tone is paired with an unconditioned stimulus which elicits an unconditioned response. The tone then becomes a conditioned stimulus for reponses such as breathing rate, heart rate, and lower skin resistance.	Rarely used with deaf-blind; long training time required. Sophisticated equipment required is not available in many areas.
Cortical Evoked Response Audiometry: Evoked Auditory Response Electrocochleography	Electrophysiological - measurement of changes in brain wave patterns (EEG) occuring at critical time periods following auditory stimulation.	Shows promise in assessing the integrity of different levels of the auditory nervous system. Not often used because it requires sophisticated equipment which is not presently available in many areas.

APPENDIX IX

"BEST TEST" TECHNIQUES FOR CHILDREN*

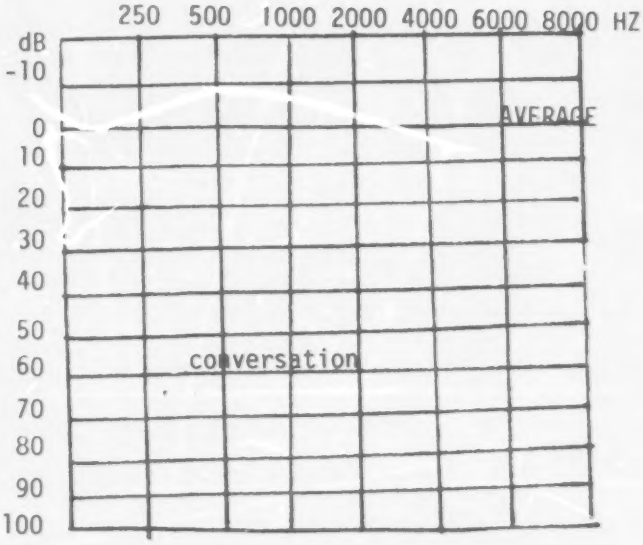
Age	Test Procedure	Information Obtained
0-6 months	Sound field localization, audiometry.	
	Elicit reflexive responses with relatively intense signals. Perhaps elicit "listening" response with softer "meaningful" stimuli.	Qualitative. Should differentiate normal and profoundly hard of hearing.
6 mos.-2 yrs.	Sound field localization, audiometry.	Especially after 1 year of age, it is easy to identify normal hearing children with this method. For those with hearing loss, a good approximation of the level of sensitivity in the better ear is possible
	Orientation response under earphones.	For those children who will respond to this technique, good approximation of sensitivity in either ear can be obtained.
	Response to speech	For children who have acquired language, good approximation of overall sensitivity is possible (for either ear if testing is done under earphones).
	Response to A/C and B/C speech	Estimate of cochlear response.
2-6 yrs.	Play audiometry. Pure tone A/C and B/C	Auditory thresholds.
	Speech awareness threshold.	Speech thresholds for children without language or loss too great to understand speech.
	Speech reception threshold.	Speech thresholds for children with language.
	Word discrimination score	Measurement of discrimination ability for children with sufficient language and speech for formal testing.
	Picture tests	Approximation of discrimination ability for children with language who have unintelligible speech.

* Hodgson, W.R., "Testing Infants and Young Children," in Katz, J., (Ed.) Handbook of Clinical Audiology, Williams & Wilkins, Baltimore, 1972.

APPENDIX X

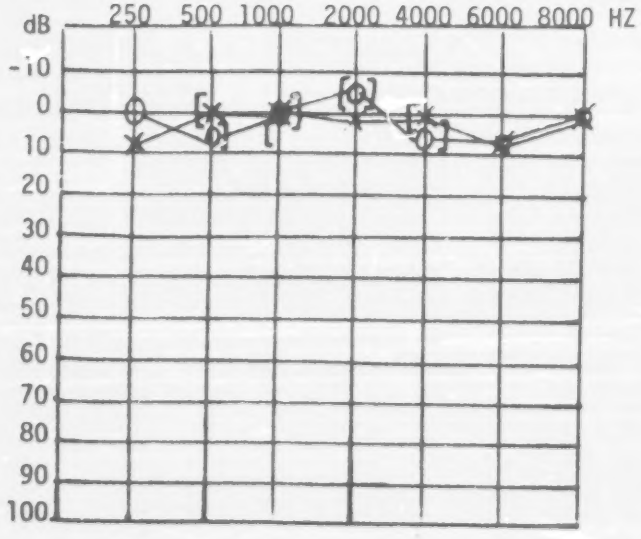
*INTERPRETING THE AUDIOGRAM

1.
The numbers across the top are cycles per second or hertz. The frequencies become higher (higher pitch) as they move from left to right.
The numbers running vertically on the left side of the audiogram refer to the intensity, or loudness of sound measured in decibels. The abbreviation for decibels is dB.



The softest sound the average person can hear is 0 decibels. Speech has to be spoken louder than zero decibels for a person to understand it. Conversational speech spoken in quiet room has a level of around 60 decibels. The sounds of speech, consonants and vowels, vary in pitch and loudness.

-10 decibels denotes hearing that is better than average. That is, the sound does not have to be as loud for the person who has exceptionally good hearing to hear it.
The numbers below 0 decibels on the audiogram denote a gradual increase in the intensity of sound. The larger the number, the more intense the sound. If a person first detects sound at 20 dB it means that it takes a more intense sound for him to hear it.



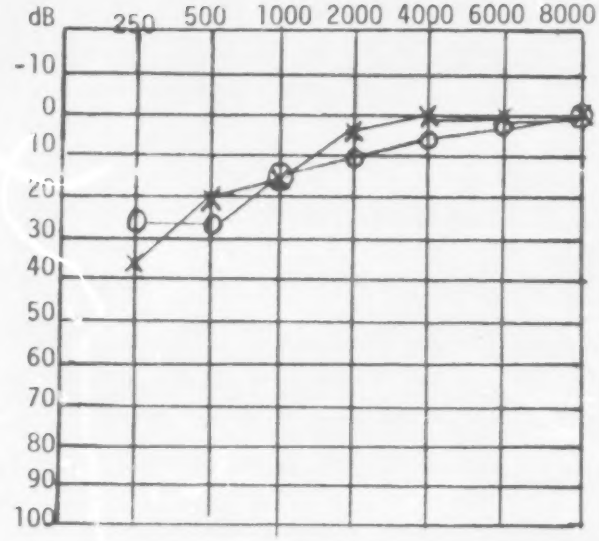
2.
When tones are measured by air conduction, measurements for the right ear are recorded with a circle O . Measurements for the left ear are recorded with an X.

When reception of tones is tested by bone conduction the right ear results are indicated by > or] and the left by < or [.

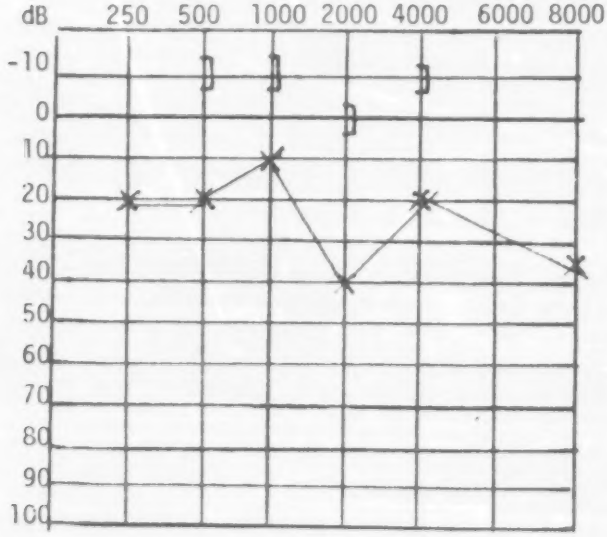
This audiogram illustrates average hearing for pitch and loudness in both the left and right ears; and average reception of sound when the ear is stimulated by movement of the skull (bone conduction).

* Evaluating the Audiogram, by Jane L. Omer, Interstate Printers & Publishers, Inc., Danville, Illinois. (adapted)

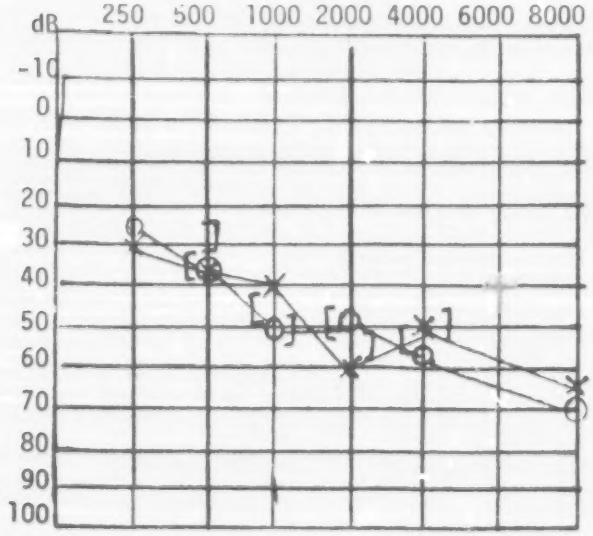
Types of Hearing Loss



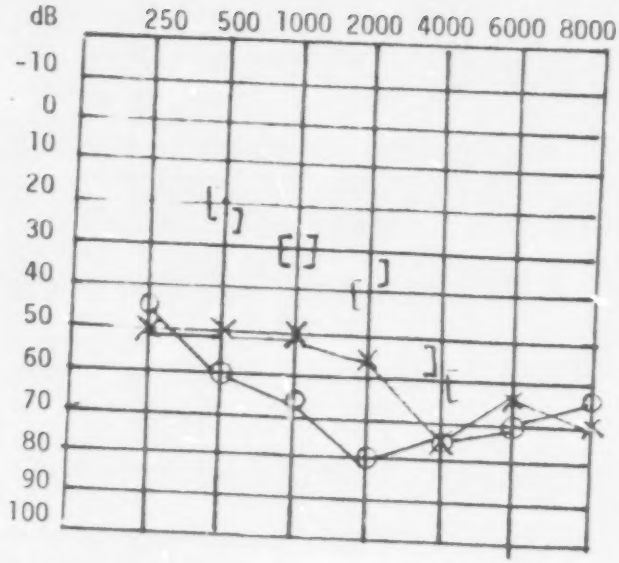
3. If there is some malfunction of the outer or middle ear a hearing loss results which is called a conductive loss. The child does not hear sound at a normal loudness level. The outer and/or middle ear is not functioning properly . Loss of hearing in the low frequencies or pitches is common.



4. A difference between air conduction and bone conduction scores indicates a conductive loss.



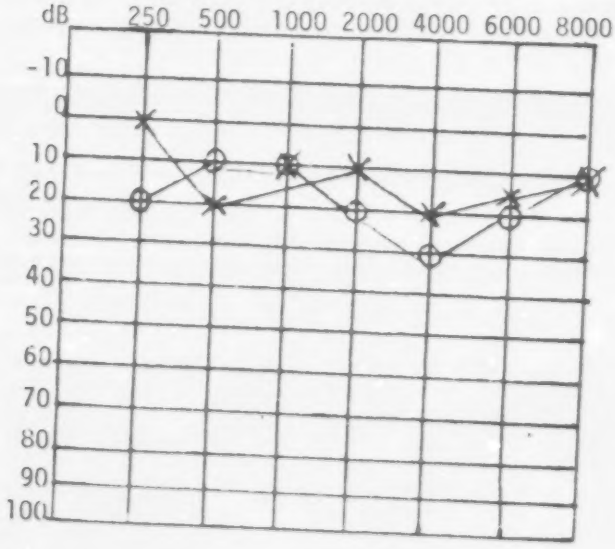
5. When the bone conduction and air conduction scores are similar there is a sensorineural loss. The inner ear and/or perhaps the VIII nerve is impaired.



6.

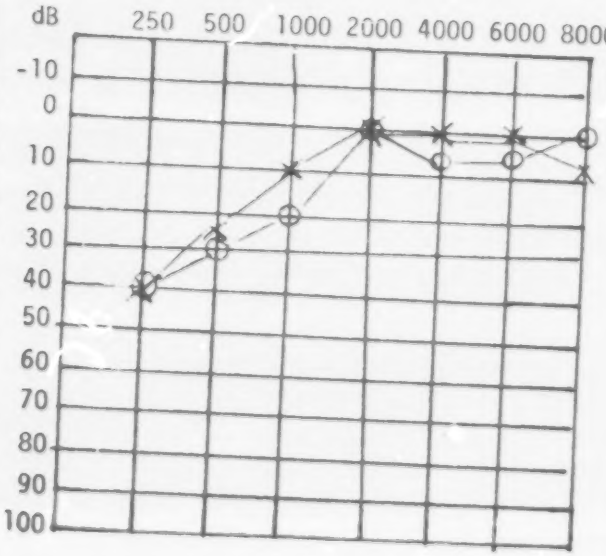
A mixed loss indicates a conbination of conductive and sensorineural loss.

The three types of hearing loss may involve only one ear or both.



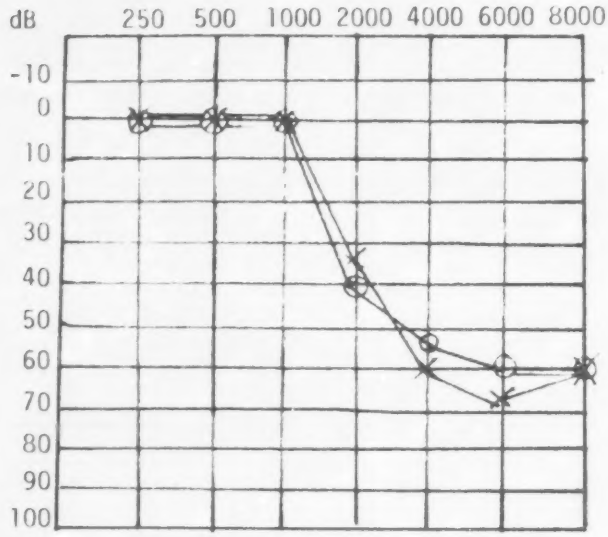
7.

Even a mild loss can be handicapping for a young child and a hearing aid may be required if medical treatment is not successful. This audiogram shows a loss of loudness in most frequencies.

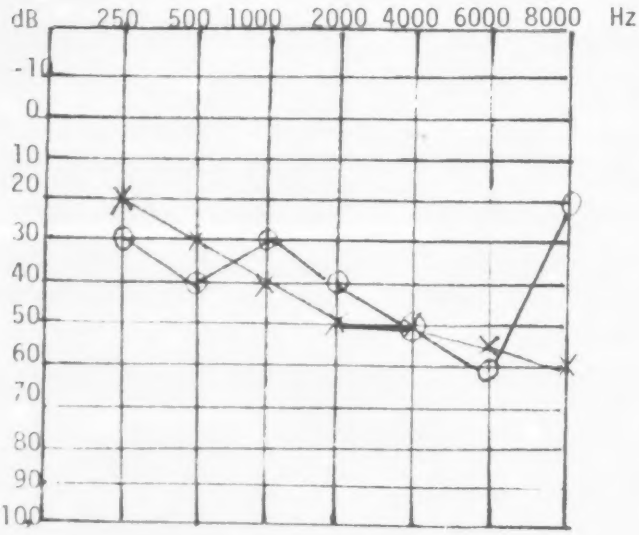


8.

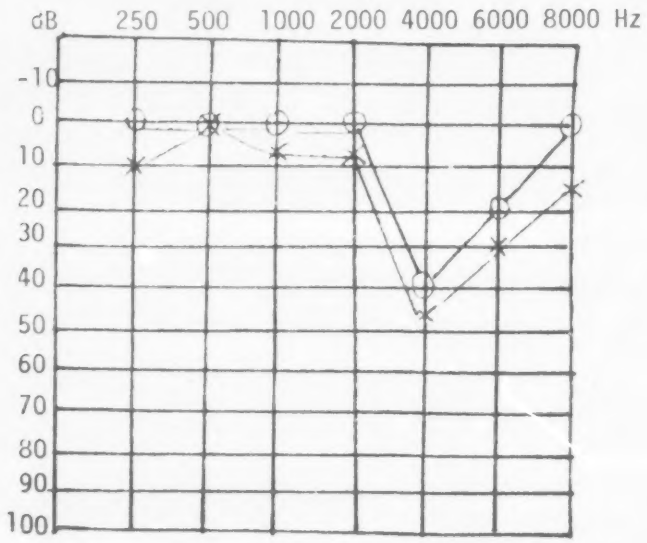
This shows a loss of hearing for low pitches (250,500,1000 Hz). Hearing is average for the higher pitches (2000, 4000, 6000, 8000 Hz).



9.
This audiogram shows a loss of hearing for high pitches (2000, 4000, 6000, 8000 Hz). Hearing is average in the low tones (250, 500, and 1000 Hz).



10.
This shows a loss of hearing in all pitches but greater in the high frequencies.



11.
This illustrates a loss of hearing at 4000 Hz in the left and right ears. The left ear also shows a loss at 8000 Hz. This kind of loss may not be handicapping, although the child will, perhaps, have difficulty in noisy places.

Name _____ Date _____

Address _____ Reffered By _____

_____ Tested By _____

Phone _____

Birthdate _____

AUDIOMETRIC RECORD

AIR A–A BONE <·····<

NR No Response
DNT Did Not Test
CNT Could Not Test

LEFT EAR

RIGHT EAR

AIR O–O BONE >·····>

Average of Speech Frqqs.

Speech Range

Detection of speech

Measurement of hearing sensitivity, made under earphones. Called "Threshold" or Pure Tone Testing

TONE DECAY

5C	1K	2K	4K

TYMPANOGRAM

Measurement of eardrum movement and middle ear function, called tympanometry or impedance audiometry (Objective Test)

5C	1K	2K	4K

Middle ear muscle tests. Tells us about both inner and middle ear function.

CLASSIFICATION OF HEARING LOSS:

NORMAL

MILD LOSS

MODERATE LOSS

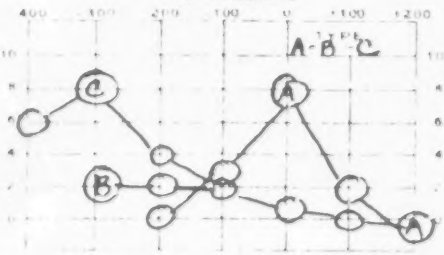
SEVERE LOSS

PROFOUND LOSS

TONE DECAY

5C	1K	2K	4K
VIIIth Nerve Adaptation			

TYMPANOGRAM



5C	1K	2K	4K

PURE TONE AVERAGE

SRT SAL

UNAIDED DISCRIMINATION

Understanding of words

AT dB

Pt. repeats or points

Difficult listening tasks

AIDED RESPONSES

Patient's own hearing aid

SRT SAL

DISCRIM

AT dB

TOLERANCE

TYPE

Data on the Patient's own hearing aid

A=Normal
B=Little eardrum movement (fluid)
C=Retracted eardrum

CONTRALATERAL

IPSILATERAL

Discomfort with loud sounds, with or without an aid.

AUDIOLOGICAL INTERPRETATION

Brief description of hearing

OTHER TEST RESULTS

Other special tests, to aid in diagnosis, referral or management. Tests, results and interpretation are stated here.

SOUND FIELD TEST RESULTS

Date	5C	1K	2K	3K	4K	6K	MLV	SAL

Responses to sound, obtained in a calibrated space, with reinforcement. Measure of sensitivity, localization used with young children.

CASE HISTORY

Historical/behavioral factors which may affect patient's hearing (family history, drugs, diseases, etc.)

RECOMMENDATIONS

Statement of recommendations based on test results, history or behavior. Person responsible for the recommendation and date stated when appropriate.

APPENDIX XI

Greg Sherburn, M.A.
Audiologist
Callier Center
Dallas, Texas

EDUCATIONALLY-ORIENTED AUDIOLOGICAL REPORT

1. What is the cause of the hearing impairment?

2. Is the hearing loss medically correctable? If not, what other measures can be taken to minimize the effects of the hearing loss? (i.e. hearing aids)

3. What type of hearing loss does this child have? Sensorineural, conductive, or mixed? Will hearing improve, become worse, or remain stable?

4. What is the degree of the hearing loss?

   a. normal 0-25 dB — no problem in the classroom

   b. mild 25-45 dB — minor to moderate difficulties in some listening situations

   c. moderate 45-65 dB — significant problem in most classroom situations

   d. severe 65-85 dB — expect very little information from the auditory channel without assistance

   e. profound 85+ dB — would not expect any useful information from the auditory channel without assistance

5. How does the audiometric configuration relate to the child's speech and his auditory reception? (The hearing threshold levels at the various frequencies.)

6. What symptoms and/or classroom behavior may be associated with the hearing loss?

   a. inattentiveness

   b. inability to localize sound

   c. change in behavior

   d. drop in academic achievement

   e. depressed awareness of verbal commands, instructions, or other environmental sounds

APPENDIX XII

AUDITORY DEVELOPMENTAL BEHAVIOR

AGE	RESPONSE - BEHAVIOR	IMPLICATION	SOURCE
0-1 week	- cochleopalpebral reflex - (eye blink, startle)	- oversensitive to sound	White and Hart
		- if startle is not present - the child will most likely not use verbal communication and will not use the auditory mode as a way to gain information or to have control over his world	Donlon and Burton
0-1 week	- baby's body movements in syhchrony with adult's words (baby's movements are in rhythm to speech patterns of adult.) (fades soon)	do our handicapped children retain this general movement pattern to voices?	Brazelton, Boer, Hart
	- sometimes tuning out sound	- because this increases with age (Gallagher) early intervention is important	
	- auditory discrimination between vocal music, instructional music and noise as evidenced in non-nutritive sucking (Brazelton, Ruder, McCarthy)	- distress, over sensitive to sound	Brazelton, White
1-2 weeks	- discrimination between voice of mother and stranger	(Hulsebus)	Franklin, Murphy, Hart, Downs
0-6 weeks	- eye blink		Franklin, Murphy, Hart, Downs
	- moro reflex (stiffening of extremities)		Franklin, Murphy, Hart, Downs
	- eye shift or widen		Downs
	- change in ongoing behavior, either increase or decrease		Franklin, Murphy, Hart
	- quiets		Perkins
	- tensing of entire body		Franklin, Murphy, Hart

GE	RESPONSE - BEHAVIOR	IMPLICATION	SOURCE
veeks nt.)	- may produce simple sounds when not in distress		White
	- habituation behavior - child responds to first few trials and then response diminishes or disappears altogether after repeated trials of the same stimuli	- rate of habituation may be an index of information processing (Miller) - failure to habituate or become agitated and alert to a repeated stimulus may suggest developmental problems - when children fail to respond is it a failure of processing or a tuning out of noxoius or aversive stimuli - preference for novel sounds	Hart, Lewis
nths	- consoles self when distressed or in presence of aversive stimuli	- do our children who cry habitually lack the ability or not know how to console himself	Hart
eks - nths	- same responses as 0-6 weeks		Franklin
	- orientation (random, general search with eyes for sound) distance of 2 feet - bell, rattle	- orienting response was found to be absent or attentuated in children suffering from malnutrition - (deaf-blind children are typically poor eaters, have food preferences and metabolism normalcy is questionable)	Franklin, Bayley
	- source of sound does not matter to child		Hart
	- eye blink - quieting		Downs
	- rudimentary head-turn		Downs
eks - onths	- startle response is dropping out - may see it during sleep	- probably can hear well enough to discriminate words but doesn't understand	White
	- entertains self by playing with sounds with his saliva (gurgle)	- no longer sensitive to loud sounds	

AGE	RESPONSE - BEHAVIOR	IMPLICATION	SOURCE
6 weeks - 3½ months (cont.)	- shrieks with delight (3 - 4 months)	- can be conditioned to sound for audiological testing	
3 months	- alerting behavior: - waking to familiar sounds (including voices) - alerting to familiar sounds - turns to familiar sounds - alerts to or laughs at familiar near sounds	- becoming familiar with sounds - associates sounds with the familiar	Perkins
4 months-7 months	- head turn on lateral plane and beginning localizing below ear (first signs of ability to localize) - 90° head turn to either side	- "listening"	Downs Franklin Franklin, Hart
6 months	- scanning behavior - ie: - in quite place turns head in response to name - anticipates at approaching footsteps - scans for tiny bell (3') - coos to music box or scans to it (3')	- "listening"	Perkins
5½ - 8 months	- visual play more important than auditory - if he sees you he will forget his sound play	- doesn't respond to his name but rather to familiarity of the qualities of your voice	White
		- if visual modality remains of primary importance-he may tune out auditory (sounds and voices) altogether and use the auditory modality only for self stimulation or as a very rudimentary form of communication	Donlon, Burton

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AGE	RESPONSE - BEHAVIOR	IMPLICATION	SOURCE
7-9 months	- in sitting position on a lap, if sound is presented to the side and on the floor, he will first turn head to side of sound and then downwards		Franklin, Perkins, Hart
	- begins responding selectively to a few simple words that have meaning to him		White
9 months	- Discrimination - ie: - "listens" to conversation - scans for music box in quiet place (5') - scans for animal wind-up toy after he becomes familiar (5')		Perkins
9-13 months	- direct localization on lateral and lower plane (to sound presented out of sight)		Franklin, Hart, Downs
12 months	- clear response to: music box (5') baby rattle (10') maraca (10') triple bell (10')		Perkins
8-14 months	- begins to react or understand simple instructions - ie: "stop that" "kiss me" "come here" - understanding about 5-6 words		White
8-15 months	- discriminates between forward and backward speech - discriminates between voices of mother and of strangers - discriminates between familiar and unfamiliar speakers using flat and bright intonations		
13-16 months	- localizes by looking first to the side and then upwards		Hart, Franklin

AGE	RESPONSE - BEHAVIOR	IMPLICATION	SOURCE
13-16 months	- direct localization on all planes		Downs
16-21 months	- localizes by looking directly above		Franklin, Hart
	- direct localization on any plane		Downs
21-24 months	- localizes sound by looking directly to any angle		Franklin, Hart, Downs

Compiled by: Cindi Robinson, Educational Consultant for Deaf-Blind, Western Missouri

Linda Van Eck, Educational Consultant for Deaf-Blind, Eastern Missouri

for "Auditory Assessment and Training Workshop," March 13-14, 1978; Kansas City, Missouri

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----Robinson and Van Eck

APPENDIX XIII

Characteristic Performance of Each Type on the Areas Evaluated in Making a Differential Diagnosis*

Type of Disorder	History	Behavioral symptomatology	Auditory Responses	Mental Capacity	Social Maturity	Motor Capacity	Language Function	Emotional Adjustment
Peripheral Deafness	Indicates alertness in general and often consistent response to loud sounds. Not bizarre or seriously retarded genetically.	Not Bizarre. Compensatory use of other sensory avenues. Integrated and use environmental cues well.	Consistent and integrated. Good listening behavior. Use hearing prohectively. Give scanning responses.	Cluster around average level. Little scatter. Integrated and consistent in performance on tests.	Good except for communication area. Average social quotient of approximately 90.	Good but balance may be disturbed. No generalized incoordination or retardation	Good inner language Good gesture. Use voice projectively. Behave symbolically.	Good responsiveness to people through vision. Social perception and contact with environment is good.
Aphasia	Indicates some retardation in development. Confusion regarding hearing. Lack of shyness but not bizarre.	Disinhibited, hyperactive and forced responsiveness. No use of other sensory avenues in compensatory way.	Inconsistent, erratic, cannot listen. Disturbed in auditory perception. No use of hearing projectively.	Inconsistent and musch scatter. Perceptual disturbances improve with structuring.	Retarded in all areas but especially in communication, socialization and motor areas. Average social quotient of approximately 75.	Slightly delayed in sitting and walking. Generalized incoordination.	Poor inner language. Little or no use of gesture. No use of voice projectively. May unexpectedly use a word. May be echolalic.	Emotional expression lacks intensity. Try to relate to people. Are not obvious or bizarre.

*From Nyklebust, H. R., Auditory Disorders in Children: Grune and Stratton, New York, 1954, pp. 352-353.

Characteristic Performance of Each Type on the Areas Evaluated in Making a Differential Diagnosis (Cont.)

Type of Disorder	History	Behavioral symptomatology	Auditory Responses	Mental Capacity	Social Maturity	Motor Capacity	Language Function	Emotional Adjustment
Mental Retardation	Retardation in all development is most characteristic.	Responsive but in low genetic and concrete manner. Not bizarre.	Respond directly or indirectly to tests which are suitable genetically. Use hearing projectively.	Marked retardation in general.	Marked generalized retardation in all areas. Average social quotient of approximately 55.	Generalised retardation with incoordination. Marked delay in sitting and walking.	Language is deficient but not seriously discrepant with mental age. Retarded in all phases of language development.	Passive, phlegmatic, infantile and deficient in animation.
Emotional Disturbance	Began using speech, then stopped. Many anxieties. Willfulness in rejection of environment. Withdrawn and in world of their own.	Bizarre, no compensatory use of senses. Not relating to people. Poor social perception. No projective use of hearing or voice and no gesture.	Seem to willingfully reject sound, give indirect responses. No projective use of hearing. Not disturbed in auditory perception. May show fear of sound. May laugh to sound.	Not perceptually disturbed. May do well on form boards. Reject the test situation in total or in part. Behavior suggests good mental ability.	Deficient in all areas but notably in socialization. Average social quotient of approximately 80.	Stereotyped activity. Rigidity and random movements. Only slight retardation in sitting and walking.	Good inner language but used only for fantasy. No use of gesture and no use of voice projectively. May be mute.	Withdrawn in own world. Lacking in relationship to people. Stereotypes and bizarre.

APPENDIX XIV

Minor Hearing Aid Problems and Their Causes

I. Weak hearing aid
- A. Battery
  1. Wrong type
  2. Leakage occuring
  3. Nearly exhausted
- B. Amplifier
  1. Sensitivity switch in low position
  2. Wrong power switch setting
  3. Wrong tone setting
  4. Mike opening facing body
  5. Mike opening clogged
- C. Cord - wrong type
- D. Earphone - faulty
- E. Ear mold and/or tubing - almost completely clogged with wax

II. Intermittent operation
- A. Battery
  1. Corrosion on battery contacts and terminals caused by leadage
  2. Carbon batteries becoming weak with use
- B. Amplifier
  1. Garment clip shorting to components
  2. Cord receptacle springs shorting to cover
  3. Loose receptacle spring contacts
- C. Cord
  1. Faulty or defective
  2. Corroded plug contacts
  3. Intermittent
- D. Earphone - check for damage from mishandling
- E. Tubing - collapses or bends when the head is turned

III. Dead hearing aid
- A. Battery
  1. Wrong type
  2. Exhausted
  3. Inserted in reverse
- B. Amplifier
  1. Tel-Mike switch in the Tel position
  2. Garment clip shorting to components
  3. Cord recept. springs shorting to cover
  4. Corroded battery contacts
  5. Corroded receptacle contacts
- C. Cord
  1. Open
  2. Corroded plug contacts
- D. Earphone - defective (open)
- E. Earmold and/or tubing
  1. Canal clogged with wax
  2. Collapsed or clogged tubing
  3. Tubing blocked with moisture

IV. Feedback or whistle
- A. Battery
  1. Wrong type
  2. Corroded contacts
  3. High impedance battery
- B. Amplifier
  1. Volume control turned too high
  2. Amplifier to close to earphone (body-level instruments
- C. Earphone
  1. Air leak between earphone & earmold.
  2. Leakage at earphone receptacle
  3. Worn nozzle causing loose fit with earmold.
  4. Worn plastic seal washer
- D. Earmold and/or tubing
  1. Worn or weak retaining ring
  2. Improper fitting
  3. Excessive wax
  4. Pinholes or split in sound conduction tube
  5. Tubing too short, may unseat ear mold
  6. Earmold is cracked

V. Poor tone or distortion
- A. Battery - nearly exhausted
- B. Amplifier
  1. Incorrect tone setting
  2. Mike opening covered or clogged
- C. Earphone
  1. Check for damage from mishandling
  2. Improper insert
  3. Diaphram damaged
  4. Wrong type

VI. Poor intelligibility
- A. Battery
  - 1. Nearly exhausted
- B. Amplifier
  - 1. Volume control turned too high
  - 2. Incorrect tone
- C. Earphone
  - 1. Wrong type
  - 2. Select various types of response
  - 3. Earphone aperture clogged
- D. Earmold and/or tubing
  - 1. Canal too long or mold needs venting
  - 2. Tubing too long
  - 3. Tubing collapsed when head is turned
- D. Earmold and/or tubing
  - 1. Clogged canal
  - 2. Canal too long or mold needs venting
  - 3. Tubing too long
  - 4. Collapsed or clogged tubing
  - 5. Excessive wax in ear

VII. Noisy or excessive clothing noise
- A. Battery
  - 1. Nearly exhausted
  - 2. Corroded terminals
- B. Amplifier
  - 1. Loose garment clip
  - 2. Garment bag not used
  - 3. Improper placement of aid
- C. Cord
  - 1. Corroded plug contacts
  - 2. Poor connection with receptable contacts
  - 3. Cord stiff due to perspiration

How to give a li tening check to a hearing aid

1. Insert a new battery, matching positive and negative terminals. If necessary, clean battery terminals and contacts.

2. Set controls:
   - a. "on/off" switch in "off" position.
   - b. Volument control at lowest setting
   - c. Switch in "M" (mike) or "MT" (mike-Tel.) position.
   - d. Tone control on setting most frequently used.

3. Place receiver to your ear. Cover the receiver with the palm of your hand. Hold the hearing aid away from your ear to prevent feedback.

4. Turn the hearing aid on. Turn the volume control wheel up and down slowly listening for scratchiness or dead spots. The volume control should neither be excessively loose, ror bind against the case. Check for distortion.

5. Turn the "on/off" switch back and forth to check for intermittent or loose contacts.

6. Change to the other tone positions and listen for appropriate changes in pitch or quality of the sound.

7. Roll the cord back and forth between the fingers to check for "cut-outs."

8. Check the firmness of cord connections. Have spare cord available.

9. Check ear molds for wax.

10. Gently tap the hearing aid on all sides to check for a reduction of power or loose connections. Check for loose screws in the case.

11. With the aid in the "off" position and the receiver out of your ear, place your thumb firmly over the opening in the receiver. Turn the hearing aid on and turn the volume all the way up. Listen for a soft whistling sound from the hearing aid case or from the receiver. The aid should be serviced if whistling or feedback is internal.

12. Clean the earmold and attach it to the receiver. Place your thumb firmly over the hole in the earmold and turn the hearing aid to its loudest position. If you hear a faint whistling at the receiver, be sure there is a thin plastic washer between the receiver and earmold or the "Receiver-Saver" is in position. Recheck the aid. Certain types of hearing aids have a washer between the cord and receiver. Your dealer will advise you if one is needed. If the whistling persists, return the hearing aid to your dealer for service.

13. If possible, have an earmold made for yourself to aid in listening to and checking each child's hearing aid.

Adapted from: Caring for a Child's Hearing Aid, Charlotte Dempsey, Audiological Services, Zenith Hearing Aid Sales Corporation.

APPENDIX XV

NORTHWESTERN UNIVERSITY
CHILDREN'S HEARING CLINIC

Parent's Guide for
Hearing Aid Trouble-Shooting

The following information will help you keep your child's hearing aid in the best working condition. Unfortunately, it has been found that many children (about one-half) are wearing hearing aids that are not working. Most problems with hearing aids can be remedied if you buy two pieces of inexpensive equipment and faithfully check the hearing aid every day.

Problem	What To Do About It
1. Squealing (acoustic feedback) at usual gain levels.	a. Check that earmold is seated properly in ear. b. Check if earmold is loose (how many months has it been since a new earmold was made?) c. Check, for ear-level aids, that hollow plastic tube from earmold fits tightly over receiver opening. d. Check that earmold fits nub of receiver snugly. e. Arrange to get a new earmold made if it is loose or cannot sit properly in ear.
2. Hearing aid does not work.	a. Replace battery. b. Make sure that positive and negative terminal of battery are in proper position in the battery compartment. c. Check corrosion on battery contacts (this can be removed with a pencil eraser.) d. Keeping aid on, wiggle cord where it inserts into receiver and into the aids (body aids, only). e. Check that ear wax (cereman) is not impacted in the opening of earmold. f. Check to see that external switch is not switched to "telephone", or to the "off" position.

3. Intermittent, "scratchy sound."	a. Wiggle cord where it inserts into receiver and aid; if intermittency or quality changes the cord needs replacing. (body aid, only). Replace and check again. b. Make sure that battery is correctly seated and snug in battery compartment.
4. Distorted sound quality, a motorboating ("put""put") effect, or weak volume.	a. Change battery (even if it reads normal on a battery tester). b. If another receiver is available, try replacing the old one.

GENERAL

1. The parents must check the child's hearing aid every morning. You should know what the adjustments do, where the battery is inserted and how to seat an earmold properly in the ear.

2. Good investments for parents are a small battery tester and a hearing aid stethoscope. These can usually be purchased from a hearing aid dealer at a nominal cost.

3. Be sure that child has spare batteries available somewhere in the school (in his possession, home teacher's room, school office, etc.) and that he knows where they are. In addition to batteries, there should be at least one spare cord available at home for body aids.

4. As soon as possible, the child should be taught to insert his own batteries, turn the aid adjustments to proper settings, and to report to you when something goes wrong with the aid.

5. All young children should receive yearly audiological and hearing aid rechecks. Older children should receive such checks at least once every two years.

6. A child who has a hearing aid is not hearing normally. However, it is to be hoped that he hears and understands better with the aid then without it. Remember that the benefit he receives from the aid is determined by the situation. For example, while the normally hearing child may have only a moderate amount of difficulty understanding speech in a noisy situation, the hearing-impaired child may experience a total lack of understanding. For this reason the ideal situation for working with your child is in the quietest area of your home.

APPENDIX XVI

University of Denver
Department of Speech Pathology and Audiology
Project Parent-Child

Rules for Auditory Stimulation

1. Select sounds and call them to your child's attention.
2. Respond to these sounds by pointing to your ear with a wide-eyed "I hear it" expression.
3. Always associate sounds and their sources.
4. Always praise your child when he reacts to sounds.
5. Construct listening and responding games that are fun for your child.

Rules for Talking (from Bill Wilkerson Hearing & Speech Center)

A. Getting and maintaining the child's ATTENTION:
   6. Get down on the child's level. . .as close to his ears as possible.
   7. Let your face and your voice tell your child that what you are doing is interesting and fun.
   8. Let your child actively participate whenever possible. . .language is best learned while doing.

B. How to make your talking RELEVANT:
   9. Talk about the here and now.
   10. Tune in to your child: talk about what interests him.
   11. Use short simple sentences.
   12. Say the obvious.
   13. At times, talk for your child.
   14. Everything has a name -- use the name.
   15. Put your child's feelings into words.
   16. Give your child a chance to respond.

C. How to use REPETITION:
   17. Say it again and again.
   18. When you use a single word, put it back into a sentence.

D. How to respond when your child talks:
   19. Give your child a chance to talk; be a listener as well as a talker.
   20. Respond when your child vocalizes.
   21. Reward your child when he attempts to say a word.
   22. Repeat the child's word and put it back into a sentence.
   23. When your child uses telegraphic speech, repeat his though in a complete sentence.
   24. Expand your child's present vocabulary by adding new words.
   25. When a child uses incorrect language, repeat it correctly.
   26. Expose your child to new sentence forms.
   27. When your child expresses an idea, expand his thoughts by adding more information.

APPENDIX XVII

Glossary of Terms Relating to Auditory Functioning

acoustic feedback: occurs when the microphone picks up and reamplifies the high-pitched squeal which results from sound leaking from the hearing aid receiver.

acute otitis media: the presence of fluid behind the eardrum caused by infection in the middle ear (with pus); this causes the eardrum to retract. Treatment may consist of antibiotics or a myringotomy; as a last resort, an adenoidectomy may be performed.

adenoidectomy: the surgical removal of the adenoids which may be swollen around the eustachian tube, blocking it and leading to pressure in the middle ear.

adventitious hearing loss: occuring after birth, due to disease or accident. The age of onset may affect speech and language patterns.

air-bone gap: occurs when a child's audiogram show better bone conduction hearing than air conduction indicating a conductive hearing loss involving the outer or middle ear.

air conduction: an audiometric test to determine the extent of hearing loss. The audiologist uses earphones. Sound vibrations go through the earphone to the air molecules to the eardrum to the middle ear bones to the cochlea. It tests functioning from the ear canal to the auditory cortex.

ambient noise: unwanted background noise.

amplification: a magnification of the intensity or loudness of a sound.

aphasia: an inability to understand language due to specific brain damage; the child hears but does not understand; not related to other mental capacities.

ANSI: American National Standards Institute (1969).

atresia: absence of the ear canal or pinna; often with absence of the eardrum and/or bones of the middle ear.

audiogram: a chart plotting hearing level dB (intensity, loudness) vs. frequency Hz (pitch); a graphic representation of a child's hearing.

audiologist: a non-medical specialist in the science of hearing who evaluates and habilitates the hearing function of children; selects and monitors hearing aids.

audiometer: an instrument used by a trained professional to determine a child's hearing acuity.

APT loss: average pure tone loss for air conduction test.

bilateral: pertaining to both the right and left sides.

binaural hearing: hearing with both ears.

bone conduction: a type of audiometric test which tells type of hearing loss; through vibration of the skull bones to the neural pathways, it tests the function of the inner ear to indicate if the loss is sensori-neural.

central deafness: interference with the neural pathways to the temporal lobes of the cerebral cortex of the brain, causing an inability to process auditory stimuli.

cerumen: wax secreted in the ear canal to lubricate the canal and trap dust. It may build up and block the canal.

complex sound: sound made up of a combination of pure tones.

conductive hearing loss: hearing impairement due to damage or obstruction of the outer or middle ear in the presence of normal inner ear. An air-bone gap on the audiogram indicates this type of loss.

congenital: present at birth.

consonants: give intelligibility information for speech; low intensity, high frequency, voiced (b,d) or unvoiced (p,t).

cps: cycles per second or Hertz; a measure of frequency, number of vibrations per second.

dB: decibel, the relative measure of intensity or loudness - 0dB is the softest sound heard and 130dB the loudest.

0dB Hearing Level: reference level for average, normal hearing level.

discrmination: a higher level of auditory perception requirng a differential response to different sounds.

dynamic range: the range over which a child can tolerate speech, from the "uncomfortable loudness level" to the "speech reception threshold" (just audible).

etiology: cause or origin of a disease.

Eustachian tube: helps equalize the pressure in the middle ear with atomosphenc pressure by connecting the middle ear to the nasopharynx (throat).

external otitis: "swimmer's ear", the tissues swell and block the hearing.

fenestration: artificial opening put in the ear for otosclerosis.

frequency: (pitch) rate of sound wave vibration per second (cps or Hertz); frequency range of human speech

functional hearing loss: when a child has no indication of a hearing loss on an audiogram yet is not able to use the hearing he has and functions like a hearing impaired child.

fundamental frequency: the lowest frequency in the spectrum of a complex signal; gives the pitch of the signal.

gain (of a hearing aid: how much it makes sounds louder (but not necessarily clearer).

glue ear: an accumulation of fluid in the middle ear; very common in 5-8 year olds and can cause deafness; cured by getting rid of the fluid.

habituation: child may "tune out" a sound in response to monotonous presentations of regular stimuli.

hearing threshold: the lowest level of intensity at which the child responds correctly 50% of the time.

Hz (Hertz): same thing as cycles per second, measure of frequency; named for German physicist, Heinrich Hertz.

homophonous sounds: speech sounds which are different, but look the same for lipreading, (p,b,m; t,d,n; k,g,ng).

impedence: resistance of the eardrum to pressure flow of energy (measured in ohms) to assess the status of the middle ear and the mobility of the eardrum. Tympanometry.

intensity: physical correlate of loudness; relative unit of measurement (dB); always need a reference value (ASA-American Standards Association, ISO-International Standards Organization); graph of movement vs. time.

JND: just noticeable difference.

mastoidits:	when a middle ear infection infects the mastoid bone of the skull which may lead to meningitis; possible complete bilateral loss of hearing.
Meniere's Disease:	increased fluid pressure in the inner ear causing attacks of dizziness, tinnitus and hearing loss; usually in one ear; sounds often seem much louder.
MRL:	minimal response level: the lowest intensity the child will respond to; at 6 months of age it is normally 20dB; at 12 months, 15dB; auditory-neural mechanisms not yet mature until 2 years so does not respond to 0dB levels.
MCL:	most comfortable loudness level.
mixed hearing loss:	symptoms of both a conductive hearing loss and a sensori-neural loss in a child (in the same ear).
myringotomy:	surgery to correct serous otitis media; an incision is made in the eardrum to drain the fluid, the drum heals. Tubes may be inserted for continuous draining.
otitis media:	inflammation or infection of the middle ear.
otologist:	medical doctor specializing in diagnosis and treatment of diseases and surgery of the ear.
otosclerosis:	a hereditary bone disease causing a stiffening or fixing of the bones in the middle ear preventing the flow of sounds to the inner ear (a conductive loss). Usually occurs in the late teens or early twenties.
pure tone:	a tone with only one frequency; it is never heard normally in the environment (complex sounds); a tuning fork produces a pure tone.
recruitment:	even though a child has a hearing loss, loud sounds are abnormally loud to him; it has a physiological base and is important to know when fitting for hearing aids; generally present only in a sensori-neural loss.
residual hearing:	remaining hearing in a hearing impaired child.
rubella:	or German Measles; a disease which, if a woman is exposed to it during the first few months of pregnancy, may cause severe hearing loss and multiple impairments to the unborn child.

sensori-neural hearing loss: due to damage in the inner ear (cochlea) or the VIII cranial nerve (auditory) going to the brain stem; generally irreversible; most congenital hearing impairments are sensori-neural.

serous otitis media: the most common childhood disease which leads to middle ear problems. If the Eustachian tube doesn't work, negative pressure builds in the middle ear (retracted drum), fluid is secreted in the middle ear, there is no place for it to drain and it builds up (s.o.m.). Treated with antibiotics or surgical lancing of the eardrum.

sound field: a room in which ambient noise is filtered out, i.e. anechoic chamber (no echos), audiological booth, sound proof room, free field.

SPL: sound pressure level, measure of how high the intensity is of a sound, e.g. 40dB S.P.L.

speech pathologist: a professional who specializes in speech, hearing, and language defects and intervention.

SDL: speech detection level; detection of presence/absence of voice, does not have to understand what is said; same thing as speech awareness threshold.

SHL: speech hearing level; more intensity than SDL required; test each ear separately with earphones; present the child with spondees (see below) making it softer until he can just hear it and repeat the word back correctly.

SRT: speech reception threshold: the softest level at which a child can identify simple speech; must be able to perceive, detect and understand what is said.

spondee: a two syllable word with equal stress on both syllables (airplane, cowboy, hotdog); used for SRT and SHL.

startle response: present in newborns, and at all ages if hearing is normal when a voice is suddenly heard at 65-70dB and at 80-85dB for white noise.

threshold:	softest sound the child can respond to 50% of the time.
tinnitus:	ringing in the ears, "head noises".
tolerance problem:	unable to tolerate a wide range of intensities, an important consideration for choosing a hearing aid.
tympanometry:	impedence audiometry, to assess the status of the middle ear by sending in negative and positive pressure, the normal peak on a tympanogram is 0.
UCL:	uncomfortable loudness level, used to fit a hearing aid, "tell me when my voice hurts your ear".
ventilating tubes:	inserted into incision in the eardrum to drain fluid from the middle ear (see myringotomy).
VDL:	voice detection level; softest level at which the child can just detect the presence vs. absence of voice, not necessary to understand what is said, less intensity required to reach VDL than SHL.
vowels:	carry most intensity for given amount of vocal effort, low frequency sounds, but they contribute very little to the intelligibity of speech.
white noise:	contains all the sounds in the audible spectrum in random order, (similar to the 's' sound).

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